DISSERTATION

ON

CLINICAL AND RADIOLOGICAL CORRELATION

IN BLUNT INJURY ABDOMEN

Dissertation submitted to

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CERTIFICATE

This is to certify that this dissertation entitled **"CLINICAL AND RADIOLOGICAL CORRELATION IN BLUNT INJURY ABDOMEN"** is the bonafide original work of **Dr.P.SATHYARAJ** in partial fulfilment of the requirements for M.S Branch -I (General Surgery) Examination of the Tamilnadu Dr. M.G.R. Medical University to be held in APRIL - 2013. The period of study was from January 2011 to june 2012.

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DECLARATION

I, **Dr.P,SATHYARAJ**, solemnly declare that the dissertation titled **"CLINICAL AND RADIOLOGICAL CORRELATION IN BLUNT INJURY ABDOMEN"** is a bonafide workdone by me at Thanjavur Medical College, Thanjavur during January 2011 to June 2012 under the guidance and supervision of **Prof.Dr.V.BALAKRISHNAN, M.S.,** Professor and Head of the department , Department of general surgery, Thanjavur Medical College, Thanjavur.

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CONTENTS

INTRODUCTION

Abdominal trauma is one of the most common causes among injuries caused mainly due to road traffic accidents. The rapid increase in motor vehicles and its aftermath has caused rapid increase in number of victims to blunt abdominal trauma. Motor vehicle accidents account for 75 to 80 % of blunt abdominal trauma[1]. Blunt injury of abdomen is also a result of fall from height, assault with blunt objects, sport injuries, industrial mishaps, bomb blast and fall from riding bicycle[1].

In view of increasing number of vehicles, rampant increase in construction work and consequent road traffic accidents, this dissertation has been chosen to study the cases of blunt abdominal trauma, its different modes of presentation and to study the different modalities of its management with reference to the patients presenting at Thanjavur medical college hospital, Thanjavur.

OBJECTIVES OF THE STUDY

1. To evaluate the importance of clinical examination in diagnosing blunt injury abdomen.
2. To evaluate the importance of radiological investigations in diagnosing blunt injury abdomen.
3. To correlate the clinical finding with radiological investigation to decide upon the management.
4. Results are analysed in terms of reduction in morbidity.

REVIEW OF LITERATURE

HISTORICAL ASPECTS:

Blunt injury as cause of intra abdominal injury have been recognized since historical times. Aristotle was the first to record visceral injuries from blunt trauma. Hippocrates and Galen are said to have given apt description of the condition. Aristotle was the first to record visceral injuries from blunt trauma. Hippocrates and Galen are said to have given correct description of the condition. By 1500 BC distinct triage and surgical protocol had been developed in Babylonia under the rule of Hammurabi as said by Edwin Smith Papyrus. In 1580 Ambriospare made a reference of traumatic herniation of stomach through diaphragm. The first operative repair of gastric injury was reported by Nollesan in the 18thcentury, and the first case of gastric injury, as well as resultant fistula, is credited to Schenk in the 16th century. The ancient Chinese used a sharp blow on the region of the spleen as a method of assassination.

ANATOMY OF ABDOMINAL CAVITY[2]:

Abdominal cavity extends just below the nipple in lower chest to deep into the pelvis. It has number of organs, some solid and other

hollow viscus. Abdominal organs are protected anteriorly only by muscles except those organs/parts lying under the lower ribs and in the pelvis. The abdominal cavity is bounded anteriorly by the rectus abdominis, laterally by external, internal and transverse abdominis and more inferiorly, the iliac muscles and posteriorly by the vertebral columns and psoas major, minor and quadratic lumborum. It is divided into nine regions for the descriptive purpose by two horizontal lines and two vertical arbitrary lines. The horizontal lines are transpyloric, at the level of pylorus of stomach or passes through the tip of the ninth costal cartilage and that passing through the intertubercle of the ileum. The two vertical lines are from midclavicle downwards. The resulting quadrants are right and left hypochondriac, middle epigastric, right and left lumbar, middle umbilical, right and left iliac, middle hypo gastric.

PERITONEAL CAVITY[2]:

The peritoneum lines the wall of the abdominal cavity. It is a serous membrane. Developmentally abdominal and pelvic viscera invaginate into the abdominal cavity carrying the peritoneum before them. This results in covering over of the organs by the visceral peritoneum that is continuous with parietal peritoneum lining the abdominal walls. The layers of opposing peritoneum between viscera

and body wall and between two organs form visceral ligaments of the abdominal cavity. The disappearance, fusion, shifting, shortening of these peritoneal folds during development divides the peritoneal cavity into two distinct parts, the greater and lesser sac. The lesser sac is situated posterior to the lesser omentum, stomach and gastro colic ligament. Right side, it communicates with the greater sac through the foramen of Winslow. The structures within the abdominal cavity which are not suspended from the body wall by the mesentery or the ligaments are retroperitoneal in position. In males peritoneal cavity is a closed cavity, whereas in females it communicates with the exterior through the openings of the fallopian tube.

GASTROINTESTINAL TRACT[2]

Stomach: The stomach is a seromuscular organ located in the intra-thoracic position of the abdomen and is well protected from injury by the overlying rib cage. It is loosely suspended in the abdomen by the gastro-hepatic ligament superiorly, the gastro-colic ligament inferiorly, and by its attachment to the spleen laterally. In addition to these attachments, it is relatively fixed at the gastro-esophageal junction and the retroperitoneal duodenum. It communicates with the esophagus at the cardiac orifice and the small intestine by the pyloric

orifice. The anterior surface is related to the diaphragm, left lobe of the liver and left rectus sheath. The posterior surface of the stomach is related to the structures forming the bed such as the diaphragm, left suprarenal gland, splenic artery, pancreas, transverse mesocolon and the spleen would also be included but it is separated from the stomach by the cavity of the greater sac.The gastric wall is made up of an external serosal layer followed by three layers of smooth muscle- an outer longitudinal layer, a middle circular layer, and an inner oblique layer. A strong sub mucosal layer is followed by a mucosal layer with a rich capillary network. The thickness and strength of the stomach wall are factors that contribute to the rarity of blunt gastric rupture. The stomach is supplied by four major nutrient arteries with extensive collateral circulation between the vascular beds.

They are left gastric, right gastric, left gastro-epiploic and the right gastro-epiploic arteries. As there is extensive collateralization of the gastric blood supply, three of the four major arteries may be disrupted without causing necrosis of the gastric wall. This allows repair of most gastric injuries without fear of devascularising a portion of the gastric wall. On the other hand, gastric injuries may bleed extensively, and care must be taken to obtain adequate hemostasis when repairing these wounds.

Duodenum: It extends from the pylorus, which lies opposite the right side of the spine at the level of the first lumbar vertebra, to the duodeno-jejunal flexure. It is roughly C-shaped and is about 25cm long. It is a unique piece of small intestine because of its deep anatomic location, retroperitoneal fixation, and connection to the secretory ducts of the liver and pancreas. The blood supply is from the coeliac and superior mesenteric vessels. This blood supply is shared with the head of the pancreas; this common arterial input may complicate management of both pancreatic and duodenal injuries. It is divided into four parts.

The first portion of the duodenum is intra-peritoneal and somewhat mobile. The remainder of the duodenum is retroperitoneal owing to the fusion of the posterior parietal peritoneum with the duodenum.

The second and right half of the third portions of the duodenum may be easily mobilized through this bloodless fusion plane, a Kocher maneuver[4]. The ligament Trietz is a fibro muscular band that suspends and supports the duodeno-jejunal flexure.

SMALL INTESTINE[2]:

The small bowel measures about 6 meters and extends from the ligament of Trietz to the caecum. It is freely moveable on its mesentery.

The upper two fifth's is jejunum, and the lower three fifth's is ileum. The fan shaped mesentery suspends the small bowel and extends from the left side of the second lumbar vertebra downwards to the right sacroiliac joint, traversing the transverse duodenum, aorta, inferior venacava, right gonadal vessels, and right ureter. The superior mesenteric artery supplies the jejunum and ileum, arising from the aorta approximately 2 cm below the coeliac trunk. After crossing the uncinate process, it enters the root of the mesentery, giving off branches to pancreas, right colic, and numerous intestinal vessels before it terminates at the medial aspect of the caecum. Importantly, there are no named vessels connecting the root of the mesentery and the retro-peritoneum.

LARGE INTESTINE[2]:

The large intestine measures about 1.5 meters in length and extends from the ileocaecal junction to the anus. It is divided into appendix, caecum, ascending colon, transverse colon, descending colon, sigmoid colon, rectum and anal canal. The ileum opens into the large intestine by a longitudinal slit, the ileocaecal orifice guarded by the ileocaecal valve. Below the orifice, the appendix opens into the caecum. The longitudinal muscle of caecum forms three ribbon like structures called the taenia coli which converge at the base of the

appendix proximally and distally, they spread out on the sigmoid colon to become continuous with the longitudinal muscle coat of the rectum.

LIVER[3]

The liver is situated in the right upper quadrant of the body. It is wedge shaped; the base of the wedge is directed to the right. It is the largest gland in the body. The anterior surface is triangular and is related to the xiphoid process and the diaphragm on either side. Above the diaphragm, the pleura and lungs overlap the liver. The posterior surface is also triangular and is marked by the vertebral impression in the middle. The superior surface is quadrilateral and is marked by the cardiac impression in the middle.

The diaphragm separates it from the pericardium and heart in the middle and from the pleura and lungs on each side. The inferior surface is also quadrilateral and has a sharp border. The liver has two lobes. Right lobe, which has two additional lobes, the caudate and quadrate lobes. Left lobe on the inferior surface presents the omental tuberosity. It is held in position by various ligaments such as falciform ligament, ligamentum teres, anterior and posterior layers of coronary ligament and right and left triangular ligaments.

Liver receives 20% of its blood supply from the hepatic artery, and 80% from the portal vein. Before entering the liver, the hepatic

artery and portal vein divide into right and left branches. Within the liver they redivide to form the segmental and then interlobular vessels which run in the portal canals. Venous drainage is from the hepatic veins, which drain directly into the inferior vena cava. The bile is drained by the right and left hepatic ducts, which join to form the common hepatic duct. With the joining of cystic duct, it becomes common bile duct and drains into the second part of duodenum.

GALL BLADDER[3]

It is pyriform in shape which acts as a reservoir for bile. It extends from the right end of porta hepatis to the inferior border of liver. The fundus of the gall bladder usually protrudes beyond the liver and is covered by the peritoneum. It is in contact with the anterior abdominal wall at the 9^{th} costal cartilage. The gall bladder is divided into three parts:

Fundus: It projects at the angle between the lateral border of the right rectus abdominis and 9^{th} costal cartilage. Body: it lies in the gall bladder fossa of the liver. Neck: is the narrow upper end of the gall bladder situated near the right end of porta hepatis. The posterio-medial wall is dilated to form the Hartmann's pouch. The cystic duct drains into the CBD. The cystic artery, a branch of right hepatic artery, supplies the gall bladder.

PANCREAS[2]:

Pancreas lies obliquely on the upper part of the posterior abdominal wall extending from the concavity of the duodenum to the spleen at the level of L1 and L2 vertebra. It is an elongated organ which has both exocrine and endocrine functions. Anteriorly, it is related to transverse colon and stomach. Posteriorly, to the aorta, inferior venacava, superior mesenteric artery and the left crus of diaphragm. The tail of the pancreas is related to the hilum of spleen.

SPLEEN[2]:

Spleen lies in the left hypochondriac region of the abdomen, its long axis being parallel to that of 9^{th} rib, behind the stomach and inferior to the diaphragm. It is a lymphatic organ connected to the blood vascular system. It is surrounded by the peritoneum and is suspended by the following ligaments.a) Gastro-splenic ligament from hilum to the greater curvature of stomach. b)Linorenal ligament from the hilum to the anterior surface of left kidney. c)Phrenicocolic ligament supports the anterior end of the spleen. Splenic artery a branch of coeliac artery, supplies it.

KIDNEYS[2]:

Kidneys are a pair of excretory organs situated on the posterior abdominal wall one on each side of the vertebral column behind the

peritoneum. The right kidney is slightly lower than the left, and the left kidney is a little nearer to the median plane than the right. Each kidney has got two poles, two borders and two surfaces. Upper pole is broad and is related to suprarenal gland, the lower pole is pointed. Lateral border is convex, the medial is concave, with hilus in the middle.Anterior surface is irregular and posterior surface is flat. Right kidney is related to right suprarenal gland, second part of duodenum, hepatic flexure of colon and small intestine.

The left kidney is related to left suprarenal gland, spleen, stomach, pancreas, splenic vessels, splenic flexure, descending colon and the jejunum. Posterior surface of both the kidneys are related to diaphragm, medial and lateral arcuate ligaments, psoas major, quadratus lumborum, transverse abdominis, subcostal vessels and the subcostal, iliohypogastric, and ilioinguinal nerves. In addition, the right kidney is related to 12^{th} rib and the left kidney to 11^{th} and 12^{th} ribs. Gerota fascia is the fibroareolar sheath surrounding the kidney and perirenal fat. Renal artery and vein supply kidneys. Renal artery is a direct branch of aorta; renal vein drains directly into the inferior venacava. The structure of kidney is composed of outer cortex and inner medulla. The urine formed is drained by major calyces and then into the renal pelvis which is drained down the ureter into the bladder.

BLADDER[2]:-

Urinary bladder is a reservoir of urine. It is a muscular structure which is lined by transitional epithelium. It lies in the anterior part of the pelvic cavity. An empty bladder is tetrahedral in (full bladder is ovoid) in shape and has an apex directed forwards, a base or fundus, directed downwards and a neck, the lowest and most fixed part of the bladder.

It has three surfaces, a superior and two inferolateral and four borders, two lateral, an anterior and posterior. As the bladder fills, the inferolateral surfaces form the anterior surface of the distended bladder, which is covered by peritoneum only in its upper part. The lower uncovered part (about 5 cm of the suprapubic region) of the bladder can be approached extra-peritoneally. The height of the suprapubic region without peritoneum varies with the degree of distension of the bladder. With excessive distension, it may extend up to the umbilicus or even higher. Blood supply is mainly from the superior and inferior vesical arteries, branches of the anterior trunk of internal iliac artery.

PATHOPHYSIOLOGY[4]:

Several pathophysiological processes take place in a case of blunt abdominal injury. Understanding the mechanisms of injury is

crucial in the management of a patient with blunt abdominal trauma. In general injuries can be classified as high energy or low energy.

1. Blunt trauma causes damage from a combination of compression, shearing and bursting forces. Sudden pronounced increase in intra-abdominal pressure created by outward forces can cause rupture of hollow viscera or can cause burst injury of solid organs.

2. Compression of abdominal viscera between the applied force to the abdominal wall and the posterior thoracic cage of the vertebral column can produce a crush injury.

3. Abrupt shearing forces can cause a tear of organs or vascular pedicles.

4. Oblique forces and deceleration injury cause shearing of viscera where anchored, such as at the duodenojejunal flexure and peritoneal attachments of the bowel.

5. Deceleration injuries occur in high speed vehicular accidents and in fall from great heights. On impact, the organs continue to move forward at the terminal velocity tearing the organs at their sites of attachment.

INITIAL RESUSCITATION OF PATIENTS AT CASUALITY

Adequate airway

This is the first and foremost important emergency measure of a severely injured patient. It may be obstructed in coma, trauma to head, face or neck, foreign body like clots, food, vomitus and laryngeal edema. Maintain airway by chin lift, jaw thrust, oral airway (in unconscious patients) and nasal airway. Protect airway from foreign bodies. Provide airway by endotracheal intubation or surgical intervention- needle cricothyroidectomy and tracheostomy.

Breathing:

This implies normal ventilation, perfusion and pulmonary circulation. It will be disturbed in ribcage injuries, pleural space collections, tracheobrochial injuries or in lung contusions, metabolic disturbances and ARDS. Provide supplemental oxygen- by mask or nasal catheter at a rate of 8 liters/ min. Stabilize chest defects. Assist ventilatory effort to maintain normal rate, rhythm and arterial blood oxygen and CO_2. Evacuate pleural space collections like air or blood by aspiration or intercostal drains connected to underwater sealed containers.

Circulation:

Generalized hypoperfusion (fatal if persistent) may result from oligemic, cardiogenic, endotoxic and neurogenic shock.

Hypovolemic shock is best prevented or controlled by starting intravenous infusion in atleast 2 extremities. A balanced solution like Ringer's lactate is usually started until blood is available. Blood for typing and cross matching is also drawn. Response to therapy is monitored by skin perfusion, urine output and CVP readings.

DISABILITY/ NEUROLOGICAL ASSESSMENT

After an adequate airway has been obtained and hemorrhage has been controlled, a gross neurological evaluation is under taken. The level of consciousness, pupillary response and motor function of the four extremities should be verified. A progressing neurologic deficit following injury to spinal cord may indicate the necessity for an emergency laminectomy. It is worth noting that pupillary response can still be assessed in paralysed patient.

DIAGNOSTIC METHODS

1. Four quadrant abdominal tap.
2. Ultrasound of the abdomen.
3. Plain radiography and contrast studies.
4. Diagnostic peritoneal lavage.

5. Abdominal CT scan.
6. Angiographic studies.
7. Radionucleotide imaging.
8. Laparoscopy.

FOUR QUADRANT ABDOMINAL TAP[1]:

Simple needle aspiration has been used for a long time to diagnose abdominal injuries. Aspiration by a large bore needle (18G) is done in right and left hypochondrium and right and left iliac fossa. The accuracy is about 80% but it is argued to have inherent risk of causing visceral injuries. But this has been disproved at large. Aspiration of even a drop of blood that does not clot is diagnostic of hemoperitoneum. But a negative tap does not rule out hemoperitoneum.

PLAIN RADIOGRAPHY AND CONTRAST STUDIES[2]:

Radiological procedures in a stable patient with blunt abdominal injury may be helpful especially when physical examination and lab investigations are inconclusive. Plain x ray abdomen should be done before other invasive tests such as paracentesis, in order to avoid confusion in detection of free air in the peritoneal cavity. Should include AP view chest, supine abdominal and erect abdominal or left lateral decubitus view, if the patient cannot stand. Chest radiograph will

help in detecting thoracic and diaphragmatic injuries. Air under the diaphragm will be found in patients with gastric, duodenal, small intestine and colonic perforations. Presence of rib, pelvic, vertebral body and transverse spinous process fractures can be made out.

General findings in case of blunt trauma would be:

a. Displaced bowel loops.

b. Enlargement or displacement of the viscera.

c. Examination with water-soluble contrast reveals extravasation secondary to rupture, displacement and mucosal thickening due to edema and obstruction due to hematoma or incarceration.

d. Splenic outline can be made out.

e. Free intraperitoneal air is defined with horizontal beam films and is seen sub diaphragmatically on erect films and sub hepatic space on left lateral decubitus. Retroperitoneal air remains more localized and is not altered greatly with the change in the position of the patient. It is commonly associated with retroperitoneal rupture of duodenum. Also occurs with tears of retroperitoneal portion of the colon or rectum. The air has a streaky appearance over the psoas muscle and can extend to outline kidney and pancreas.

f. At least 800ml of intraperitoneal blood is required to be evident on plain abdominal radiograph. The following supporting signs may be observed.

Hemoperitoneum causes small bowel to shift towards the centre of the abdomen with the production of ground-glass appearance.

DIAPHRAGMATIC TRAUMA

Plain x ray abdomen shows: Malposition of the nasogastric tube is often the first sign of a ruptured left diaphragm. Mediastinal shift to the side opposite of the injury, bowel loops above the diaphragm are seen. In duodenal rupture both intra and retroperitoneal, x ray studies are diagnostic. Free air or retroperitoneal air will be demonstrated as water soluble contrast will delineate the site. In pancreatic injuries, enlargement of pancreas namely, widening of the duodenum sweep impression on the posterior aspect of the stomach, separation of the stomach from the transverse colon and depression of the transverse colon can be seen. Impression on splenic flexure gas shadow termed as colon cut off sign is also seen. Left psoas margin may be blurred.

DIAGNOSTIC PERITONEAL LAVAGE (DPL)[4]:

DPL was introduced by Root et al in 1965. It provides a rapid, inexpensive, accurate and relatively safe adjunctive diagnostic modality in the management of patients with blunt abdominal trauma.

Reasons for performing a DPL:

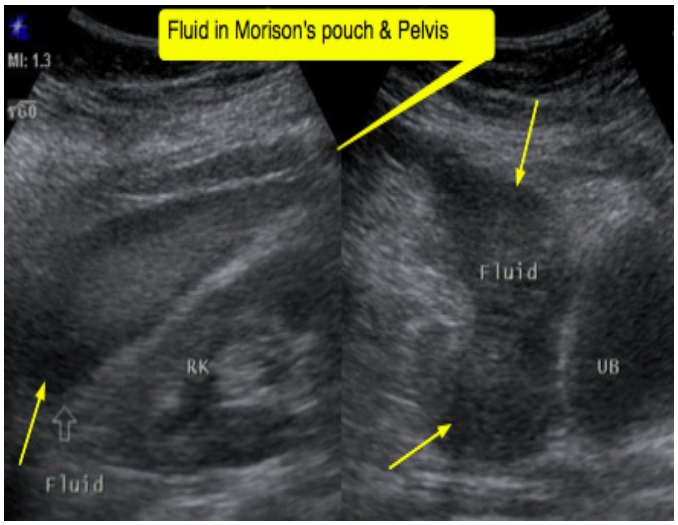
- Signs those are equivocal or obscured by adjacent soft tissue injury.
- Unreliable signs owing to head injury, intoxication or paraplegia.
- Signs those are difficult to assess because the patient is undergoing lengthy radiological or extra abdominal surgical procedures
- Unexplained hypotension or blood loss, even if abdominal examination is normal.

POSITIVE RESULT:

- >5ml blood on immediate aspiration.
- Obvious intestinal contents.
- >1,00,000 RBC's/cmm or 500 WBC/cmm in the drained lavage fluid.
- Elevated amylase level.

ULTRASOUND OF ABDOMEN[1]:

As quality ultrasound machines have become portable there is an increasing trend of their application in the initial evaluation of blunt abdominal trauma. Ultrasound can demonstrate the presence of free intraperitoneal fluid as well as the extent and precise location of solid organ hematomas.



COMPUTERISED TOMOGRAPHY ABDOMEN

CT scan evaluate solid organ injury and in stable patients with positive USG findings, it is indicated to grade organ injury and evaluate contrast extravasation. If extravasation seen, even with minimal splenic/hepatic injury, exploratory laparotomy or angiographic embolization are indicated. The retroperitoneum is best evaluated by CT.

Presence of freefluid on CT without solid organ injury should raise

the suspicion of hollow viscus injury.The accuracy of CT range from low false positive and false negative rates.

6. RADIONUCLEOTIDE IMAGING[1]:

This non-invasive nature of isotope studies makes them attractive as a screening procedure. The reduced radiation dosage permits repeat and follow up studies with safety. But the obvious disadvantages are they are not freely available in most centers and are dependent on the availability of an expert radiologist.

7. ARTERIOGRAPHY[4]:

Arteriography was main tool prior to CT scan and ultrasound. Its use is now limited for the evaluation of solid intra abdominal and pelvic arterial bleeding in patients with pelvic fractures.

Therapeutic embolization can be carried when needed. Abdominal aortography or selective visceral arteriography is useful in the diagnosis and management of intra abdominal bleeding after laparotomy for trauma. Contraindications to do arteriography are obvious need for laparotomy, unstable patient or allergic to the contrast agent. The primary advantage is to prevent negative laparotomy.

8. LAPAROSCOPY OR DIAGNOSTIC LAPAROTOMY[1]:

It has distinct advantage over a paracentesis because it provides visualization of the site and extent of bleeding.

MANAGEMENT OF INDIVIDUAL ORGAN INJURIES

LIVER INJURIES[3]:

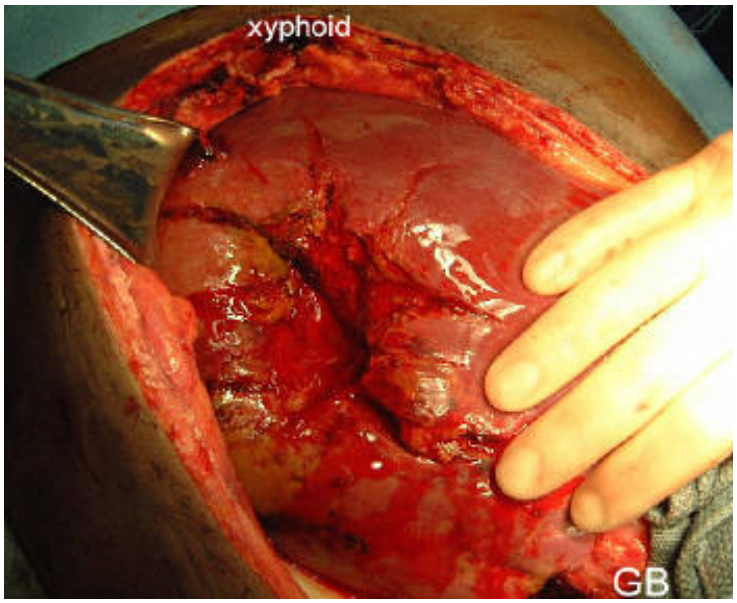
The liver is the second most commonly injured organ in all patients with blunt abdominal trauma.

Classification of liver injuries (organ injury scaling system)[1]

Grade	Type of Injury	Description of Injury
I	Hematoma	Subcapsular <10% surface
	Laceration	Capsular tear, <1cm in parenchymal depth
II	Hematoma	Subcapsular <10% - 15 % surface area; intraparenchymal, < 10 cm in diameter
	Laceration	Capsular tear, 1-3 cm in parenchymal depth; < 10 cm in length
III	Hematoma	Subcapsular, >50% surface area of ruptured Subcapsular or parenchymal hematoma; Intraparenchymal hematoma >10cm or expanding.
	Laceration	>3cm parenchymal depth.

IV	Laceration	Parenchymal disruption involving 25% - 75% of the hepatic lobe or 1-3 couinaud segments
V	Laceration	Parenchymal disruption involving >75% of the hepatic lobe or >3 couinaud segments within a single lobe
	Vascular	Juxtahepatic venous injuries., i.e., retrohepatic vena cava / central major hepatic veins
VI	Vascular	Hepatic avulsion

LIVER LACERATION



CLINICAL MANIFESTATIONS:

Major hepatic injuries are usually easy to detect because of the location of trauma, profound hypotension temporarily responsive to the infusion of blood and fluids and marked abdominal distension. Small hepatic tears from blunt trauma or lacerations from stab wounds are usually more difficult to detect as hemorrhage from such injuries may be limited and might have stopped by the time the patient arrives in the emergence center for evaluation. For these reasons a variety of diagnostic agents have been utilized in recent years to evaluate possible hepatic injuries.

INVESTIGATION:

1. Laboratory investigations may be variable in liver injuries; a very low hematocrit on hospital admission is more likely to result from vascular injuries in the porta hepatis or from associated extra hepatic vascular injuries.
2. Diagnostic peritoneal lavage (DPL): a peritoneal lavage is usually considered to be positive and laparotomy has been recommended with a red cell count of greater than 1,00,000/cmm in the recovered irrigant. A positive peritoneal lavage is non-specific as to the site and magnitude of injury.

Accuracy is around 95%. DPL may be useful when there is altered mental status due to head injury or drugs, including alcohol, where physical examination is unreliable.

3. **CT scan:** CT scan can specifically identify an injury such as disruption of hepatic architecture and intrahepatic bleeding, subcapsular or intra hepatic hematoma and perihepatic blood can be seen. An infusion CT scan might reveal decreased density in an area of liver with compromised blood supply. CT has clearly become the gold standard among the imaging modalities available for evaluation of hepatic trauma.
4. Plain x ray chest and abdomen: altered liver border,hemoperitoneum and associated rib fractures
5. **Ultrasound:** can reveal a break in the liver contour and disruption of normal hepatic architecture. Fluid that is presumed to be blood may be visualized around the liver. Can be used as a screening procedure.
6. Radio isotope scanning: may show filling defects in the hepatic substance due to intra-hepatic hematoma, a fracture may result in a contour defect on the isotope scan.
7. **Arteriography:** outlines an intra-hepatic hematoma, extravasation of dye or a fracture of the liver, but non

invasive techniques can provide the same information.

It is preferred imaging technique in the evaluation of post operative hemorrhage and for hemobilia.

MANAGEMENT:

Resuscitation:

Approximately 80% of all patients who die of hepatic injuries do so in the perioperative period from hemorrhage and hypovolemic shock. Profound hypothermia is frequently present with severe hepatic trauma, particularly after repeated transfusions of non warmed blood.

The most important resuscitative technique in the patient with a major hepatic injury includes insertion of large bore IV lines in the upper extremities, rapid transfusion with warm crystalloid solution and type specific blood and early operation for controlling of ongoing hemorrhage.

Indications of exploratory laparotomy

are:

1. All patients with hepatic trauma whatever may be grade of injury; if they are hemodynamically unstable or become unstable after being stable initially.

2. Patients who are hemodynamically stable and detected to have hepatic injury on USG or CT scan but the facilities for non operative protocol do not exist.
3. Patients of hepatic trauma who have been put on non operative protocol and develop:
    a) Deterioration in vital signs or continuing need of transfusion
    b) Increased abdominal tenderness or development of new peritoneal signs.
    c) Progressive expansion of the hematoma or laceration as documented by repeat CT scan and
    d) An intrahepatic or subcapsular hematoma thought to represent septic focus.

PRINCIPLES OF OPERATION

Incision: the upper abdomen is best explored in patients with blunt trauma through a midline upper abdominal incision.

Initial evaluations: the presence of blood and clots in the right upper quadrant may signal the presence of a hepatic injury. When these clots are removed, inspection and palpation may identify the fracture or disruption of hepatic substance. In the absence of other abdominal injuries, attention is directed to the hepatic injury.

MANAGEMENT OF ACTIVELY BLEEDING LIVER[4]:

First and foremost aim of exploration is to stop active bleeding from the liver.

MANUAL COMPRESSION:

Once the abdomen is entered and serious bleeding is encountered, manual compression is the first life saving maneuver the surgeon should attempt. It is applied from right and left margins of the liver towards the center. At the same tine, a posterior directional force may help tamponade bleeding in the retrohepatic surface and posterior perihepatic space.

Portal traid occlusion: the Pringles maneuver is usually the first step in attempting to stop hepatic bleeding particularly if there appears to be arterial component, by means of artery occlusion/ interruption.

SELECTIVE HEPATIC ARTERY LIGATION

Indicated when selective clamping of the extra lobar hepatic artery causes cessation of arterial bleeding in a hepatotomy site or parenchymal laceration and the injured vessel cannot be clearly visualized inside the liver. Either the right or the left hepatic artery is ligated. If the right hepatic artery is ligated, cholecystectomy is done to prevent gangrenous cholecystitis.

PERIHEPATIC PACKING

The technique involves the insertion of laparotomy pads or rolls of gauze around the injured liver, (not into hepatic lacerations) i.e. between the diaphragm and the liver, below the liver and laterally until sufficient pressure is generated to achieve hemostasis.

Excessive packing should be avoided because it may compromise cardiac inflow from the IVC. When packing is on a raw surface, a small steri-drape is placed between the packs and the liver. This prevents disruption of hemostasis when the pack pads are removed during reexploration. Closed suction drains are placed and the patient is transferred to the intensive care unit where vigorous rewarming is instituted and attempts are made to treat the coagulopathy.

When hemodynamic instability, acidosis, hypothermia and coagulopathy have been corrected the patient may be returned to the operation theater for pack removal. This is usually at least 24 hours later and should be within 72 hours. Re operation serves not only to remove the packs, but also to debride nonviable hepatic tissue, suture, ligate specific bleeding point and lacerated bile ducts, irrigate the abdomen of clots and establish new drainage.

SURGICAL CLAMPS:

The various surgical clamps for liver falls into two categories:

1. Occluding, noncrushing clamps and
2. Crushing clamps.

These clamps are large enough to encompass fully the thickest part of the liver, both posteriorly and anteriorly. Successful placement of these clamps, which often requires previous dissection of the ligamentous attachments of the liver, stops the bleeding dramatically. This rapid cessation of bleeding permits further patient resuscitation and definitive ongoing treatment of the anatomic injury in a dry surgical field.

LIVER SUTURE:

Direct suturing of the liver should be an adjunctive procedure, not a first step. In the liver suture one must avoid creating a dead space, which may lead to abscess formation or hemobilia. Ideally liver sutures should be placed parallel to any laceration to control the bleeding by compression of the hepatic substance rather than apposition of cut edges. Parallel sutures control the hemorrhage and leave the wound open, permitting proper drainage of the wound without dead space.

It is a heavy absorbable suture on a large, curved blunt tipped needle. This suture may be passed deeply into the hepatic substance several centimeters from the site of injury, passes deeply through the hepatic substance outside of the wound, and exits on the opposite site, as a figure of eight or simple suture. It should be tied lightly enough to oppose the edges of the fracture and to control hemorrhage.

DEBRIDEMENT:

Small fragments of amputated and devitalized hepatic substance should be removed. The resulting defect does not require closure. Occasionally, hepatic injury is of such severity as to require a major resection of devitalized tissue, resectional debridement.

This usually is an avulsion injury (Grade IV) and will often involve the right lobe of the liver. Major injuries of the lateral segment of the left lobe of the liver (segment II and III) are usually treated by resection debridement. But major hepatic resections for trauma carry an excessive mortality.

OMENTAL PACKS:

Stone and Lamb (1975) have recommended the use of omentum as a living pack. If additional length is desired, the omentum can be mobilized from the transverse colon from left to right. The wound is closed with sutures around the omentum. It

eliminates dead space and compresses small vessels. Besides, the omentum is a rich source of macrophages and helps in combating sepsis.

MESH HEPATORRAPHY

The goal of prosthetic encapsulation of the liver is obtaining sufficient compression of the liver parenchyma, and thus to achieve hemostasis. Absorbable mesh is wrapped around the liver in such a fashion as to compress the liver after freeing its peritoneal attachments. The use of mesh is best adopted to grade III, grade IV and lobar tears.

POST OPERATIVE COURSE:

In a case of major hepatic resection, there may be deficiency of coagulation factors, hypoglycemia and hypoalbuminemia. These are replaced by infusion of 10% glucose, coagulation factors and salt free albumin. Nutritional support is essential in all cases of severe liver injury.

POST OPERATIVE COMPLICATIONS

1. Post operative hemorrhage/ hemobilia
2. Intra abdominal abscess
3. Hyperpyrexia
4. Biliary fistula
5. Abdominal compartment syndrome

NON OPERATIVE APPRΘACH[4]

Non operative management of stable patients with hepatic injuries diagnosed on CT is now practiced in many centers. CT criteria for non operative management are:

1. Simple hepatic parenchymal laceration or intra hepatic hematoma. Grade I and II injury (CT evaluation).
2. No evidence of active bleeding.
3. Intra peritoneal blood loss less than 250ml.
4. An absence of other intra peritoneal injuries requiring operation.
5. Ready access to CT scan and operation theater.
6. Availability of surgeon / radiologist with extensive experience in interpreting the CT scans.

SPLENIC INJURIES[1]:

It is the single commonest visceral organ to rupture following blunt trauma.

PATHOLOGY:

t is usually an avulsion from the pedicles, multiple fissure fractures, an enlarged spleen splitting on its outer aspect to produce either a tear or subcapsular hematoma. Less usually is a small tear in the anterior aspect of hilum, which may produce severe bleeding but will escape from detection.

SPLENIC INJURY SCALE[1]:

Grade	Type of Injury	Description of Injury
I	Hematoma	Subcapsular, <10% of surface area.
	Laceration	Capsular tear, <1cm in parenchymal depth
II	Hematoma	Subcapsular <10% - 50 % surface area; intraparenchymal, < 5 cm in diameter
	Laceration	Capsular tear, 1-3 cm in parenchymal depth; and not involving a trabecular vessel
III	Hematoma	Subcapsular, >50% surface area or expanding, rupted Subcapsular or parenchymal hematoma; Intraparenchymal hematoma ≥ 5 cm or expanding.
	Laceration	>3cm parenchymal depth or involving the trabecular vessels
IV	Laceration	Laceration involving the segmental or hilar vessels and producing major devascularization (> 25% of spleen)
V	Laceration	Completely shattered spleen
	Vascular	Hilar vascular injury that devascularizes the spleen.

CLINICAL PRESENTATION:

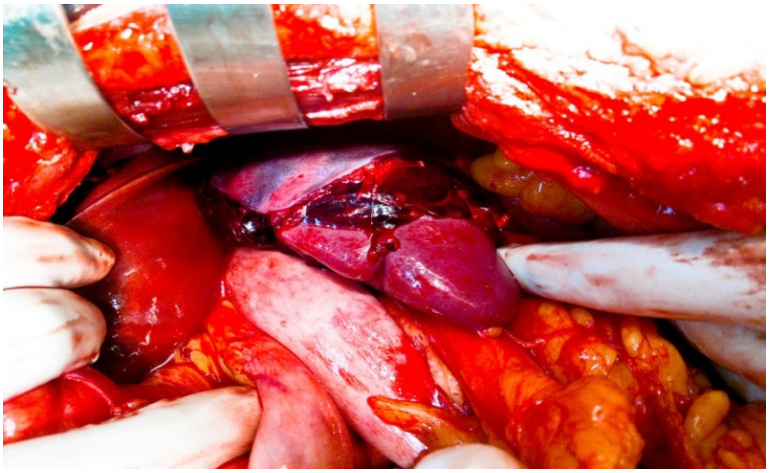
1. Patient may succumb rapidly to trauma, without recovering from shock.
2. Initial shock followed by recovery with signs of rupture.
3. Delayed rupture after few days.

The diagnosis can be made by four general methods.

- ❖ History of injury in the recent past with general signs of blood loss associated with local signs like bruising, tenderness, rigidity, fractured ribs, Balance's sign positive, Kehr's sign positive.
- ❖ Presence of palpable tender spleen.
- ❖ Radiography: plain x ray may show:
  - Fractured lower ribs on left side.
  - Elevation of left dome of diaphragm or pleural effusion.
  - Diaphragmatic rupture.
  - Increased density in the left upper quadrant.
  - Displacement and indentation of greater curvature of stomach.
  - Transverse colon displaced downwards.
  - Radioisotope scanning is useful in diagnosis in about 90% of cases.

- Patients with symptoms referable to the spleen may be evaluated with ultrasound, scintigraphy, angiography, CT or DPL.

SPLENIC LACERATION



Ultrasound has been used successfully in the diagnosis of splenic injury and remains useful adjuncts in the absence of CT. Because it is rapid and non invasive, it is recommended to follow the healing of a known hematoma. Ultrasound has its own technical drawbacks, including image limitation by dressings, tubes, wounds, gastrointestinal ileus, and problems with positioning a severely injured patient.

Contrast enhanced CT detects splenic trauma with a high degree of accuracy. Its major advantage is a relatively specific delineation of the degree of organ injury.

DPL is easy, rapid, accurate and is used in hemodynamically unstable patients or in patients with associated injuries requiring immediate treatment.

Radioisotope scanning is useful in diagnosis in about 90% of cases. Advantage of scintigraphy over CT includes its feasibility in the moving, uncooperative patient and a lower risk of contrast reaction.

Angiography has been used to demonstrate splenic injury, as well as to document persistent arterial bleeding. It is invasive, time consuming, expensive and requires an angiographer with expertise in

imaging the trauma patient, hence not widely used.

MANAGEMENT:

PREOPERATIVE CONSIDERATIONS:

Proper management of patients with blunt injury spleen begins with resuscitative regimes. Adults should receive a rapid infusion of 1 to 2 liters of lactated ringer solution. Children should receive lactated ringer solution on per weight basis (20 ml/kg).

A naso gastric or a oro gastric tube should be positioned to decompress the stomach., blood should be sent for blood typing and cross matching and blood transfusion to be started immediately, if possible, reserving further blood for intra operative period. Once in the operating room auto transfusion systems are available for recovery and reinfusion of blood vessels.

Once the decision has been made to proceed with operation, the surgeon should carefully consider the need for each of the following: additional intravenous access, peri-operative monitoring (i.e., central venous catheter, arterial catheter), peri- operative antibiotics, and blood transfusion.

OPERATIVE MANAGEMENT[4]:

The patient is positioned supine on the operating table and may be

rotated 15 degrees toward the operating surgeon (standing on right side) so that there is greater exposure of the left upper quadrant. A midline incision, with adequate extension to the xiphoid, is preferably used to facilitate exposure and treat associated injuries.

Complete mobilization of spleen is the key to adequate assessment of injury and safe repair. With adequate retraction of the left upper quadrant, the splenic exploration begins by direct visualization and careful palpation. Any blood should be evacuated from the area in order to optimize visual and palpatory examination.

If splenic injury is apparent, spleen should be mobilized form its surrounding attachments, the lienorenal and phrenicocolic ligaments are avascular and can be sharply incised away from the lateral margin of the spleen. The vessels in the lienocolic and gastrosplenic ligament may need to be ligated and divided. Complete removal of clot is necessary to assess the extent of splenic injury. Clot can be removed by gentle irrigation or grasping with forceps. Persistent massive bleeding from spleen usually can be controlled by manual compression of the splenic organ.

If this is not successful temporary control of the splenic artery at the superior pancreatic margin by grasping the splenic pedicle with thumb and fore finger is helpful when there is persistent active

bleeding.

The decision to perform splenectomy or splenorrhaphy is based upon the condition of the patient and the condition of the spleen. Splenectomy is done without equivocation in patients who remain in shock after control of the splenic pedicle, and in patients who have other potentially life threatening problems, such as severe head trauma or thoracic trauma with poor gas exchange or widened mediastinum.

Because attempts at splenorrhaphy can prolong the operation, splenectomy is strongly considered in patients with medical contraindications to prolonged surgery, such as coagulopathy, hypothermia and cardiac, pulmonary or hepatic disease. Age of the patient should also be considered especially in equivocal cases.

If the patient's condition does not contraindicate splenorrhaphy, especially in younger patients, the degree of splenic injury should dictate operative method.

Grade I injuries:

Injuries consist of small subcapsular hematoma and laceration that involve splenic capsule and minimal amount of parenchyma. These require little or no treatment. Tamponade with a dry sponge for 5 minutes or topical hemostatic agent applied to the injury site is quite sufficient.

Grade II injuries:

Include larger capsular hematomas, medium depth laceration of parenchyma or multiple grade I injuries. These can be treated with hemostatic agents (including microfibrillar collagen, gelfoam soaked in topical thrombin, or surgicel) with tamponade to control bleeding. Continued bleeding from grade II injuries is treated by direct suture of the spleen (splenorrhaphy). The firm parenchyma is approximated using monofilament such as chromic catgut or polypropylene on a large needle. Mattress sutures are placed over a buttress of omentum, Teflon pledgets or a topical hemostatic can be used to minimize capsular tearing.

Grade III injuries:

The principles involved in treating these injuries are:

- Removal of clot and devitalized tissue, complete reapproximation of parenchymal edges to the depth of the wound to avoid leaving dead space, and suture placement within the fibrous splenic capsule well away from the wound margin to prevent tearing
- Expanding hematomas should be opened, the clot evacuated and a diligent search made for parenchymal arterial bleeding, which can be controlled with suture ligature.

- Another technique is to use polyglycolic acid mesh wrapping it around the spleen to partially approximate sections after local hemostasis has been performed with sutures.

Grade IV injuries:

These often require partial splenectomy for segmental devascularization. Hemostasis in the hilum is attained by selective ligation of the appropriate segmental artery. Debridement is accomplished by finger fracture or sharp resection at the line of demarcation. The resected splenic surface is treated with a combination of through and through capsular suture and hemostatic agents. An omental pedicle may also be used to seal the raw surface. As described in grade II injuries, wrapping of absorbable mesh can also be used to tamponade grade IV injuries. Splenectomy should be done if, after a reasonable attempt, splenorrhaphy is unsuccessful.

Grade V injuries:

Splenectomy is advised for grade V injuries. It is now used in 40-60% of splenic injuries. In modern trauma centers, it is particularly advised when patient is in hypotension and with multiple associated intra abdominal injuries. The hand is passed around the outer surface of the spleen, the posterior layer at lenorenal ligament divided largely

by blunt dissection and the spleen rotated medially into the incision. A large pack is inserted and short gastric vessels and those in the pedicles are ligated and divided. It is important to separate the tail of pancreas from the vessels in the hilum before ligation.

POST OPERATIVE COMPLICATIONS:

Atelectasis, pneumonia (especially left lower lobe), and left pleural effusion are the most common complications of splenectomy. Left sub phrenic abscess or effusion Thrombocytosis, OPSI**.** Young children are at increased risk and the mortality is reported to be 50-80%. The organisms most frequently responsible are encapsulated (streptococcus pneumoniae, hemophilus influenza and neisseria meningitides), but Escherichia coli and other coliforms have been cultured from patients with this syndrome. Hence all patients should be given polyvalent pneumococcal vaccine following splenectomy if possible hemophilus influenza type B vaccine.

NON OPERATIVE MANAGEMENT OF SPLENIC INJURIES[4]

Non operative management of splenic injuries in children has become common and is successful in over 90% of cases in which it has been attempted (grades 1-3). Non operative management

is successful in children because of the hemostatic properties of the splenic capsules.

The splenic capsule of a child is thicker (due to and increased capsule-parenchymal volume ratio) than the splenic capsule of adults and the capsule in children contains some myoepithelial cells, which may have constrictive properties.

Non operative management of splenic trauma has also been adopted for adults. The following are the criteria for selecting candidates for non-operative management of splenic injury.

- Blunt trauma – no history of hemodynamic instability.
- An isolated splenic injury (grades 1-2)
- Alert (no head injury or intoxication)

Only grade I and II injuries are entered into non operative method. The patient is admitted to ICU and vital signs are closely monitored and the patient is kept ready for operation, should there be evidence of hemodynamic instability or persistence of bleed from spleen. Stay in ICU is for 48-72 hours and CT is repeated. Adults receive a maximum of 2 units of blood before non operative management is aborted. Patient is discharged after 7 days and called upon for follow up at 4 weeks and 12 weeks. Restricted activity is followed for 12 weeks.

Operative repair is safe in both adults and children, with a 1% incidence of rebleeding necessitating reoperation

STOMACH[1] -

Blunt gastric injuries most commonly occur after motor vehicle or motor pedestrian accidents. Injuries have also been reported after cardiopulmonary resuscitation, falls and direct violence particularly involving child abuse.

The most common mechanism of injury is a sudden increase in intraluminal pressure resulting from a direct blow to a full stomach in which case the rupture occurs along the anterior surface of the stomach or the greater curvature. In CPR, the injury is due to compression of the stomach against the vertebral column. Shearing of the walls of the stomach with rapid deceleration occur at the gastro esophageal junction, gastric necrosis due to avulsion of gastro epiploic vessels.

DIAGNOSIS:

A nasogastric tube placed during the resuscitation phase, serves both diagnostic and therapeutic functions. The return of gross blood on nasogastric aspirate is suggestive of an upper gastrointestinal injury. The NG tube also serves therapeutic function by decompressing the stomach. Patients may present with signs of peritoneal irritation or shock. Gas under the diaphragm in plain x ray abdomen is seen, but is

not a constant finding. Peritoneal lavage is usually positive for blood or gastric contents.

MANAGEMENT[4]:

Perioperative antibiotics prophylaxis should be instituted and is continued for 12 to 24 hours after operation. On opening the abdomen with a midline incision, control of hemorrhage is the first priority, followed by containment of enteric spill.

Priority is given to management of other intra abdominal injuries in case they are found, as gastric injuries are rarely life threatening. Enteric spill from gastric injuries is controlled by Babcock and figure of eight stitch temporarily.

When exploring the abdomen, the entire stomach should be examined carefully with special attention to gastro esophageal junction, greater curvature at the omental and splenic attachment, lesser curvature at the gastrohepatic ligament, posterior wall of the stomach.

Most of the blunt injuries of the stomach can be managed by simple debridement and repair. Partial or complete transection and devascularization injuries though rare may need resection. Repair is accomplished by two layer inverting closure. Inner layer is a continuous absorbable using chromic catgut or polyglycolic acid suture.

Care should be taken not to narrow the gastric lumen when repairing wounds in the area of the gastroesophageal junction or the pylorus.

Consideration may be given to performing a pyloroplasty in wounds involving the pylorus. A gastric drainage procedure should also be performed for injuries along the lesser curvature when damage to the vagal nerves has occurred. Repairs in other areas of the stomach are rarely difficult because of the mobility of the stomach and its rich blood supply. These injuries generally heal rapidly and without complication. Drainage of these wounds is not indicated. Before closure of the abdomen, the peritoneal cavity should be irrigated to remove gross contamination. Gastric decompression, through nasogastric suction is maintained until bowel function returns.

COMPLICATIONS:

Intraperitoneal abscesses, disruption of gastric repair, fistula formation, missed injuries, hemorrhage and obstruction of gastro esophageal junction or pylorus.

DUODENUM[4]:

Blunt duodenal injuries are rare since it is a deep seated retroperitoneal organ in the abdomen. It is associated with high

mortality and morbidity due to difficulty in initial assessment and establishment of diagnosis.

A force that impacts the duodenum against the vertebral column would produce a crushing injury, i.e a direct blow to the abdomen by the steering wheel.

Usually associated injuries are present. The second portion of the duodenum is more commonly affected and pose greater technical difficulty for surgical management. The small thin walled duodenum has marginal blood supply shared with pancreas. Therefore it is not amenable to sound technical closure and parts of it are very difficult to respect.

It is also fixed at two points, the portal triad and ligament of Trietz, there by subjecting it to deceleration injuries. Pancreas is invariably affected when duodenum is involved by crush injuries. High volume and high toxicity of duodenal contents account for disastrous effect when break in the duodenal wall occurs. The incidence of fistula following repair ranges from 2 to 14%.

Associated injuries: Liver, pancreas, small bowel and colon are the organs most frequently involved with duodenal injuries.

DIAGNOSIS:

A high index of suspicion is required when evaluating patients

with history of blow to upper abdomen especially in a patient with steering wheel injury to abdomen. Abdominal discomfort may be out of proportion to physical signs. May be associated with late signs of rebound tenderness, abdominal rigidity, referred pain in the back can occur.

INVESTIGATIONS[15]

1. Serum amylase is sensitive but non specific for duodenal injuries, is elevated in 50% of patients with duodenal injuries.
2. Needle paracentesis or lavage will often be positive for blood, bile or bowel contents. A negative peritoneal lavage does not exclude all duodenal injuries.
3. X ray erect abdomen may show intraperitoneal air, retroperitoneal air around kidney, or air in the biliary tree.
4. An emergency upper gastrointestinal series with water soluble material (gastrograffin) is a good way to exclude a duodenal injury.
5. CT scan with contrast may demonstrate small amounts of retroperitoneal gas and extravasated intestinal contrast material.

TREATMENT[4]:

The duodenum must be adequately explored to exclude injuries if there is a retroperitoneal hematoma in the right upper quadrant. Other signs requiring exploration include crepitus or bile staining along the lateral margin of the duodenum, retroperitoneal edema, petechiae or fat necrosis in the retroperitoneum or right mesocolon, retroperitoneal phlegmon and discoloration. If these signs are present, the duodenum should be completely mobilized using Kocher maneuver and reflection of the right colon mesentery, if necessary, to see the third and fourth portions of the duodenum. Duodenorrhaphy or simple repair will be successful in 70-85% of these wounds. A one or two layer closure can be used. A one layer closure with a Weinberg stitch may be particularly helpful in avoiding luminal narrowing in the pyloric channel area.

Simple small laceration of the duodenum can be repaired primarily in two layers, inner continuous absorbable sutures 2-0 and outer non absorbable 3-0 silk. It should be closed transversely. The periduodenal area should be drained.

The addition of tube decompression to simple closure remains controversial. Tube duodenostomy can be accomplished directly

through the duodenal wall in proximity to the site of injury, by placement of a transnasal sump tube through the pylorus onto the duodenum or by retrograde insertion of a sump tube through a Witzel tunnel jejunostomy.

Large injuries of the duodenum are more difficult to repair. Injuries involving more than 50% of the duodenum should not be primarily closed, because it could compromise the lumen. If duodenum has been transected edges should be trimmed and two layer primary anastamosis done provided transection is not in proximity to the ampulla of vater.

Large injuries of duodenum can also be treated with a jejunal patch by bringing a jejunal loop and laying it on the area of injury so that the serosa of jejunum buttress the duodenal repair. If duodenum alone has been injured, a rare occurrence, the patient has to undergo a duodenojejunostomy to the defunctional Rou- en Y limb of jejunum. If there are associated injuries to pancreas or biliary tract pancreatico duodenectomy may be necessary and the necessary pancreatic, gastric and biliary anastamosis to be done. When pancreatic injury is associated, raising the concern of digestive action of pancreatic enzyme on the repair, pyloric exclusion is done to defunctionalise the duodenum and protect the repair from activated pancreatic enzyme.

The procedure involves, antrectomy, oversewing of the duodenal stump, tube decompression at the duodenum and biliary tract and gastro jejunostomy to restore gastro intestinal continuity.

PANCREAS[1]:

The incidence of pancreatic injury in severe abdominal trauma patients is about 3-12% with blunt trauma contributing about 1/3 of these patients. The spectrum of pancreatic injuries is broad, ranging from simple contusion to fracture/ laceration to complete disruption. The proximity of the pancreas to other vital structures and the high energy mechanisms typically involved make isolated pancreatic injuries uncommon. Wounds of the head of the pancreas are commonly associated with blunt injuries to the liver, duodenum and major vascular structures. Injuries to the body are associated with blunt trauma to transverse colon. Injuries to the tail of the pancreas are associated with injuries to the spleen. Associated organ injuries to pancreatic injuries are frequent in liver, stomach, vascular system, small bowel and colon, spleen, kidney, duodenum and biliary tract on descending order.

Mechanism of injury:

Blunt pancreatic injuries occur when high energy crushing force is applied to the upper abdomen. The majority of blunt

pancreatic injuries result from motor vehicle accidents. The energy of impact is usually directed at the epigastrium or hypochondrium, resulting in a crushing of the retroperitoneal structures. At least 60% of blunt injuries to the pancreas are due to the impact of the steering wheel, although any high energy blow to the epigastric region can damage the pancreatic parenchyma. Epigastric pain out of proportion to the abdominal examination is often a clue to a retroperitoneal injury. Following is the commonly used method of classification of pancreatic injuries.

CLASSIFICATION OF PANCREATIC INJURIES[1]:

Type	Definition
1.	Contusion and laceration without duct injury
2.	Distal transaction or parenchymal injury with duct injury
3.	Proximal transaction or parenchymal injury with probable duct injury
4.	Contusion and laceration without duct injury
5.	Massive injury, Ampulla destroyed, devascularisation.

DIAGNOSIS[4]:

Most patients with injuries to the retroperitoneal pancreas will have minimal clinical symptoms and signs when seen first after trauma; reason for this is the retroperitoneal location of the organ which masks the early development of peritonitis. Secondly,

tamponading effect of retroperitoneum may prevent significant blood loss from pancreatic injury.

Thus symptoms may be absent for 12 hours. Severe epigastric pain out of proportion to the clinical features may indicate pancreatic injury. **Serum amylase:** though not specific, serum amylase (isoenzyme) levels should be followed in a patient in whom there is a suspicion of a pancreatic injury or in whom the first amylase drawn in the emergency room has been elevated.

A progressive rise in the amylase over the first 24 hours of hospitalization is strongly suggestive of injury at either the pancreas or the duodenum. When associated injuries are seen, signs and symptoms which were discussed earlier will be seen.

COMPUTED TOMOGRAPHY:

May provide direct information about the location of pancreatic injuries as well as providing 3 dimensional picture of the wound. However pancreatic injuries may be missed. Diagnostic peritoneal lavage will show negative results since pancreas is retroperitoneal.

LAPAROTOMY:

The single most reliable means of making the diagnosis of pancreatic injuries.

MANAGEMENT[4]:

General principles involved in the management of pancreatic injuries are:

1. Control hemorrhage and contain bacterial contamination.
2. Debride devitalized pancreatic tissue.
3. Preserve at least 20-50% of functional pancreatic tissue whenever possible.
4. Provide adequate internal or external drainage of pancreatic injuries or resections.

A management plan based on these principles requires that the surgeon ascertain the following:

1. The presence or absence of associated organ injuries, particularly the duodenum.
2. The degree of pancreatic parenchymal disruption.
3. The integrity of the main pancreatic duct and ampulla.

TYPE 1:

Contusions and lacerations without duct injury.

Minor pancreatic contusions and capsular lacerations account for 60% of all pancreatic injuries. Minor lacerations of the parenchyma without major ductal disruption account for an additional 20% of

pancreatic injuries. These require only hemostasis and simple external drainage. Attempt to close or repair capsular laceration may result in pancreatic pseudocyst, whereas a controlled pancreatic fistula is usually self limiting. Between 2-15% of the patients with grade I injuries will develop a pancreatic fistula, but most are low output (<500ml/day) minimally affected by oral intake and mostly close spontaneously within 2 weeks.

Type II and III injuries:

Distal parenchymal transection or injury with duct disruption is best treated by distal pancreatic resection with or without splenectomy. Splenectomy makes distal pancreatectomy easier and more rapid because the splenic artery and vein as well as distal tip of the pancreas need not be dissected. The remaining proximal duct should be closed with a direct suture ligature either as U stitch or a figure of 8 with non absorbable suture. The parenchyma is controlled with mattress sutures placed through the full thickness of the pancreatic gland from anterior to posterior capsule to minimize leak from the transected parenchyma. A small omental patch can be used to buttress the surface and a drain should be left near the transection line.

Distal pancreatic resections are classified as extended, major or limited. Extended resection are those to the right of the superior

mesenteric vessels for a grade IV injury, major are those with transection between the superior mesenteric vessels and the inferior mesenteric vein and limited resection are those with transection to the left of the inferior mesenteric vein. The last two are performed for grade III injuries. Approximately 80% of the pancreas can be resected before a patient is at risk of endocrine insufficiency and diabetes.

Grade IV and V injuries:

They are defined as a ductal disruption to the right of the superior mesenteric vessels. These injuries have following spectrum.

1. There may be major injuries to the pancreatic head with or without ductal damage.
2. There may be injury to the pancreatic duct or the common bile duct in the juxta duodenal location or both.
3. There may be pancreatic injury with major duct disruption combined with a very severe duodenal injury.

Injuries to the head or neck, which do not involve the pancreatic duct, are simply drained. Severe damage to the head of the pancreas, even in the absence of duodenum injury is particularly serious. Hemorrhage from the portal vein, vena cave, aorta or mesenteric vessel will often result in exsanguinations during or shortly after surgical attempts at control of the injuries. Presuming that such injuries either

are not present or are adequately controlled, there are several options to deal with grade IV and V injuries but the treatment has to be tailored to the individual patient.

1. Extended pancreatectomy involving 80-90% of the gland will result in insufficiency. In order to avoid this after transecting the pancreas at the level of injury, closing the proximal pancreatic resection, an internal drainage from the distal fragment is accomplished by Roux-en-Y distal pancreato jejunostomy.
2. Onlay Roux-en-Y: major injuries to the pancreatic head without ductal damage is best treated conservatively by sump drainage. If the duct is damaged an onlay Roux-en-Y loop is probably the best procedure.
3. Duodenal diversion: these are more suited when the duodenal injuries are complex with pancreatic head injury. There are two ways of achieving this:
   i. Pyloric exclusion:
   ii. Duodenal diverticulization
   iii. Pancreaticoduodenectomy

COMPLICATION:

- Fistula
- Abscess
- Pancreatitis

SMALL BOWEL INJURIES[1]:

Jejunum is the most common hollow viscus injured in blunt injury abdomen.

DIAGNOSIS:

The diagnosis of blunt injury to the small intestines is often difficult due to lack or late appearance of physical signs. It may take several hours before classical signs of peritonitis are evident, given the typically slow leakage of intestinal contents, which are minimally irritant to the peritoneum. Impaired sensorium due to head injury may add to the difficulty.

Pain abdomen following blunt injury, tenderness, guarding, and rigidity of varying grade should arouse the suspicion of small gut injury till not proved otherwise by various diagnostic tests. An upright chest x ray will demonstrate gas under the diaphragm in 20-50% of cases.

Diagnostic peritoneal lavage appears to offer a much higher diagnostic yield. This may be improved further by measuring alkaline phosphatase levels in the lavage fluid. However negative diagnostic

lavage does not rule out intestinal injury.

USG and CT scan are not much of help. Serial physical examination preferably by the same surgeon seems to give best results. When in doubt exploratory laparotomy is the only faultless test for the diagnosis of intestinal injury.

MANAGEMENT[9,18]:

There is no role of conservative management in small intestinal injury. Midline incision is preferred. The entire small intestine must be carefully examined from the ligament of Trietz to ileocecal valve, including all mural surfaces and mesenteric attachements.

Perforations:

Most perforations are closed by primary repair. Edges are debrided till it bleeds and two layers closure done. i.e inner layer of absorbable and outer layer of silk. When there are multiple perforations in a close area or the closure of large laceration results in narrowing, resection anastamosis is done. Resection anastamosis should not be performed in last 15cms of ileum due to precarious blood supply. Rather end to side ileocolic anastamosis is preferred. Peritoneal cavity must be liberally irrigated with warm saline and particulate matter removed. Drains are optional.

AIR UNDER DIAPHRAM

Mural damage without perforation: the management of contusions and intramural hematomas of the small intestines require assessment for consideration of resection and anastamosis verses leaving the intestines in situ and opting for observation and second look surgery. Clinical judgement by observing the involved segment for signs of intestinal viability such as active peristalsis and color through out the procedure is important. Small mucosal hematoma (<1cm), nonexpanding may be turned in by a series of interrupted sutures.

For larger mucosal hematoma transmural debridement/ segmental resection should be done whenever there is doubt regarding viability.

COMPLICATIONS:

Post operative complications are missed injury, bleeding, suture line leak, anastomotic disruption, fistula formation, obstruction and abscess.

COLON AND RECTAL INJURIES[1]:

Colon and rectal injuries: blunt abdominal trauma to the colon is rare and constitutes about 4-6% of all blunt abdominal injuries usually caused by road traffic accidents. The injury involves more than one organ system.

MECHANISM OF INJURY:

The bowel may be compressed against vertebral column or burst by a sudden blow against a distended loop. Sudden deceleration may tear the bowel or disrupt its mesentery. Crush injury may damage the colon or rectum in two ways. Pelvic fracture may produce perforation of the rectum by bone spicules, and occasionally, an explosion injury associated with valsalva at the time of crush may occur. Mortality rate ranges from 3-10%.

The extra peritoneal rectum is usually injured in association to the pelvis. This portion of the rectum is more or less fixed to the pelvis; thus may sustain severe injury in common with pelvic fracture. The site of trauma in intra peritoneal injury to the large bowel is usually near the

junction of the mobile and fixed portion such as junction of the sigmoid and descending colon. Injury may be to the bowel or mesentery. Injuries to the mesentery results in hemorrhage; if to the bowel; it results in contusion, intra mural hematoma or laceration (partial or complete).

Most of the injuries will be recognized and dealt as acute problem. Few may manifest later as colocutaneous fistula and post traumatic stenosis.

Injuries to extra peritoneal rectum are due to:

1. Fractured pelvis lacerating the rectum by a bony spicule.
2. Avulsion at the rectum as a result of tremendous bursting force.
3. Avulsion may be partial or complete. Organ injury scale for colon and rectum is as follows.

DIAGNOSIS OF THE INJURIES[1]:

Following injury varying intensity of pain in abdomen is present. Tenderness, guarding and rigidity may or may not be present. Shock is due to blood loss as a result of other associated injuries and not due to colonic injuries. Occasionally, symptoms of peritonism may take few hours or days to develop. There may be blood on finger on per rectal

examination or tenderness in pelvic peritoneum may be noticed. When bleeding is present per rectal examination should be followed by proctoscopy and rigid sigmoidoscopic examinations.

Plane x ray may show gas under the diaphragm. USG abdomen may not contribute much. Enema with water soluble contrast CT scan in selected cases may be done where the symptoms are minimal and the diagnosis is doubtful. High index of suspicion and repeated clinical examination is mostly rewarding. Clinical deterioration in the patient's status, increased abdominal tenderness, an evolving pattern of sepsis, and development of paralytic ileus or mechanical obstruction are common findings in patients with either a missed injury or delayed perforation. And majority of colon injuries are diagnosed intra operatively.

Surgical options available are:

1. Primary closure without colostomy.
2. Primary closure with de functioning colostomy.
3. Resection and anastamosis.
4. Exteriorisation of injured colon/colostomy.
5. Exteriorised repair.

A number of factors have been identified which contribute to postoperative complications and influence the choice of procedure.

RISK FACTORS:

Shock, fecal contamination, associated injuries, interval from injury to repair, mechanism of injury, severity of colon injury and location of injury.

METHODS OF REPAIR[18,25]:

Primary repair (simple suture): simple suture is resumed for clean low velocity injuries that require debridement and involve less than 25% of the colon circumference. The criteria are minimum blood loss, minimum fecal contamination, within 8 hours of injury.

Accepted contraindications for primary closure are:

- Prolonged or persistence hypotension
- Greater than 6 hour delay between injury and surgical intervention
- Gross fecal spillage
- Extensive damage to abdominal or retroperitoneal muscle
- Significant hemoperitoneum
- Multiple coexistence visceral injuries
- Devitilization of more than one fourth of the colon wall
- Impairment of blood supply to the injured segment

- Colon injury grade 3 or more

Most of the authors report primary repair in 50-65% of their patients. The technique involves thorough and meticulous debridement of the wound edges followed by a standard two layer closure (an inner layer of running or interrupted absorbable sutures followed by an outer layer of interrupted silk Lembert sutures). Prior to facial closure, the abdomen is liberally irrigated with saline and all particulate matter is removed. Drains are normally not indicated. The skin and subcutaneous tissue may be closed primarily with or with out a subcutaneous drain/ or by delayed primary method.

Primary resection and anastamosis: This procedure is ideal when there are extensive wounds of the right colon. Right hemicolectomy with ileocolic anastamosis can be accompanied with reasonable dispatch and an acceptable rate in the majority of patients. Hemodynamically unstable patients should have ileostomy, if, taking time for anastamosis will jeopardize their survival. Primary anastamosis may be performed in the left colon following resection of extensively damaged portion but it should be protected by a proximal colostomy.

Colostomy: indications for colostomy are: when the condition of the patient precludes taking the time to make a repair or anastamosis; when a distal anastamosis may be tenuous, when extensive distal

destruction of the colon would require a low rectal anastamosis.

It may be accomplished by:

1. Exteriorization.
2. Defunctioning colostomy
3. End colostomy and Hartmann procedure.

Exteriorization of the colon: it is the most rapid method available for managing a colon injury. Even in the fixed portions of the colon, mobilization can be accomplished quickly. If exteriorization is selected as an option, a small lateral incision is made and the two limbs of the mobilized colon are brought out as a double barreled colostomy.

Defuctioning colostomy: it is performed by separating the limbs and bringing each out as a single stoma.

Exteriorized repair: this procedure should be reserved for the rare patient on whom primary repair is in question. It is usually done when there is anti mesenteric injury from the mid ascending colon down to the sigmoid.

MANAGEMENT OF RECTAL INJURIES

1. Extra peritoneal rectal injury
    a. Primary closure
    b. Diversion colostomy with washout of the distal rectal stump
2. Intra peritoneal rectal injury
    a. Primary repair with diversion colostomy

KIDNEY, URETER AND BLADDER INJURIES[1,4]:

Blunt injuries to kidney occur as a result of high speed automobile accidents, fall from motor cycle/ bicycle, pedestrian struck by a car or a blow/assault to the loin compressing the kidney between the 12^{th} rib and lumbar vertebra.

I. MINOR INJURIES: (85%)

1. Contusion: there is bruising of renal tissue and macro or microscopic hematuria; no gross parenchymal damage.
2. Laceration: when there are radial lacerations across the kidney, up to the surface or up to the calyces, but no fragmentation.

II. MAJOR INJURIES: (15%)

3. Rupture: when lacerations are through and through- thus causing fragmentation of the kidney; blood supply of the small fragments may be jeopardized.
4. Shattered kidney: when there are multiple fragments of the kidney, many of them devascularized.
5. Pedicle injury: injury to the major blood vessels of the renal pedicle, with or without parenchymatous injury.

DIAGNOSIS:

1. **Urinalysis:** there will always be hematuria
2. **Intravenous urography:** this is an essential investigation, that must be done in all cases suspected to have renal injury and should be done as early as possible.
3. **Ultrasonogram:** is of value in detecting pre-existing or developing hydronephrosis, urinoma and para-renal pseudohydronephrosis. It is indicated early in cases of non functioning kidney (on IVU) to detect parenchymatous state and site of hematoma- intra renal or pre-renal.
4. **Computed tomography scan:** is preferred modality of investigation for blunt injury. It provides better information of

lacerations if present and blood collection within gerota's fascia. Other organs of abdomen are also defined simultaneously. Small areas of infarct, 1cm are easily detected on CT scan. In contrast enhanced CT, renal infarcts are classically described as cortical rim sign.

MANAGEMENT[1,4]:

Renal contusions and lacerations (type I and II) make up 85% of blunt injuries and are to be treated conservatively. The remaining 15%, which contribute to major (type III and IV) renal injuries need surgical intervention. Vascular injuries make 2-5% of renal injuries and need immediate resuscitation and exploration in view of the deteriorating condition and hypovolemic shock. Surgical intervension needed in

1) deep cortical medullary laceration with extravasation
2) Large perihepatic hematoma
3) Vascular injury of renal pedicle

COMPLICATIONS:

1. Secondary hemorrhage
2. Late hypertension
3. Pseudocyst and Urinoma

BLADDER INJURIES[1,4]:

Urinary bladder is located deep within the bony pelvis and hence blunt trauma to bladder is rare. It commonly occurs following application of blunt external force to a fully distended bladder and usually associated with fracture pelvis.

Classically described as intraperitoneal or extraperitoneal injury; depending on the site of injury. Extraperitoneal injuries occur in 75% of the cases and are generally in association with fractures of the pelvis.

CLINICAL FEATURES

Presentation of bruising over the lower abdomen, tenderness which is not well localized. Extravasation of urine and inability to void urine or hematuria may be present.

DIAGNOSIS

Plain X-ray pelvis confirms presence of fracture pelvis and the position of the fracture fragments. Cystogram is diagnostic. 250-300

ml of sterile contrast material is used to distend the bladder. Free flow of contrast in the peritoneal cavity is classical, highlighting the bowel loops in intraperitoneal rupture. Drainage films with empty bladder will establish presence of residual extravasation of urine in extraperitoneal rupture of the bladder.

MANAGEMENT:

Extraperitoneal rupture: Ideally managed by keeping an indwelling catheter for 10-14 days and allow rupture site to heal spontaneously.

Intraperitoneal rupture: Open primary repair of the bladder in one or two layers with absorbable sutures is preferable. Supra pubic bladder catheter is kept and perivesical space is drained.

RETRO PERITONEAL HEMATOMA

The optimal management of retro peritoneal hematoma depends on a number of factors including the cause, location and the presence of associated injuries.

The retro peritoneal hematoma can be divided into three anatomical zones for the purpose of decision making.

1. Central Retroperitoneal Hematoma. This is usually associated with

pancreatico duodenal injuries or major abdominal vascular injuries.

2. Flank or Perinephric Hematoma

   This may be associated with injuries to Genito Urinary tract or injury to the colon.

3. Pelvic Hematoma

   These injuries are confined to or originating from the pelvis and are mostly associated with pelvic fractures.

BLUNT ABDOMINAL VASCULAR INJURIES:

Abdominal vascular injury after blunt trauma is not common, if present usually involves renal arteries, retro- hepatic venacava, or the ileac vessels in association with fracture of bony pelvis

MATERIALS AND METHODS

SOURCE OF DATA

This study is a prospective study of blunt abdominal injuries during the period from January2011 to June 2012 in Thanjavur medical college hospital, Thanjavur. Number of cases studied is 52.

METHODS OF COLLECTION OF DATA

Data were collected from the patients by their clinical history, clinical examination with appropriate investigations on those patients who were admitted. After initial resuscitation of the trauma victims, a careful history was taken to document any associated medical problem. Routine blood and urine tests were carried out in all the patients. Documentation of patients, which included, identification, history, clinical findings, diagnostic test, operative findings, operative procedures and post operative outcome were all recorded on a proforma specially prepared. Demographic data collected included the age, sex, occupation and nature and time of accident leading to the injury.

After initial resuscitation and achieving, hemodynamic stability, all patients were subjected to careful examination, depending on the clinical findings; decision was taken for further investigations such

as four-quadrant aspiration, x ray abdomen and ultrasound and CT abdomen.

The decision for operative or non operative management depended on the clinical examination and results of diagnostic tests.

Patients selected for non operative or conservative management were placed on strict bed rest, were subjected to serial clinical examination which included hourly pulse rate, blood pressure, respiratory rate and repeated examination of abdomen and other systems. Appropriate diagnostic tests especially ultrasound of abdomen and CT abdomen were repeated as and when required.

Apart from routine investigations, abdomen x ray was done in 47 patients. 49 patients under went four-quadrant aspiration. An aspiration of blood, which did not clot, bilious aspiration, aspiration with flakes was taken as positive. When the aspirate clotted, the test was taken as negative.

Ultrasound of abdomen was done in 22 cases. CT abdomen was done in 15 cases.

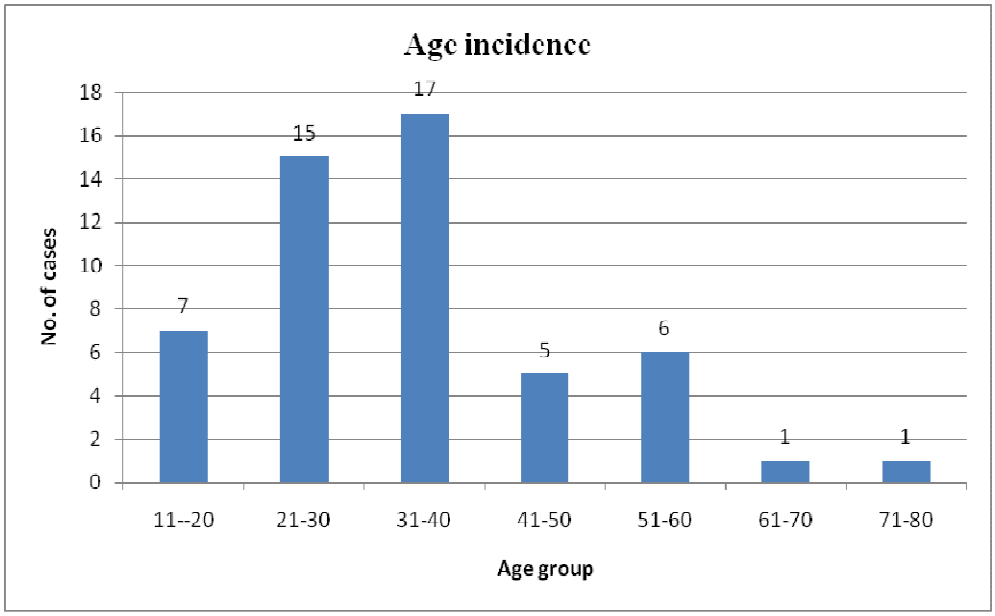
OBSERVATIONS AND RESULTS

A) AGE INCIDENCE

AGE GROUP (yrs)	NO.OF PATIENTS	PERCENTAGE (%)
11-20	7	13%
21-30	15	29%
31-40	17	32%
41-50	5	9%
51-60	6	11%
61-70	1	2%
71-80	1	2%

In this series, the majority of the patients belonged to 31-40 years age group.

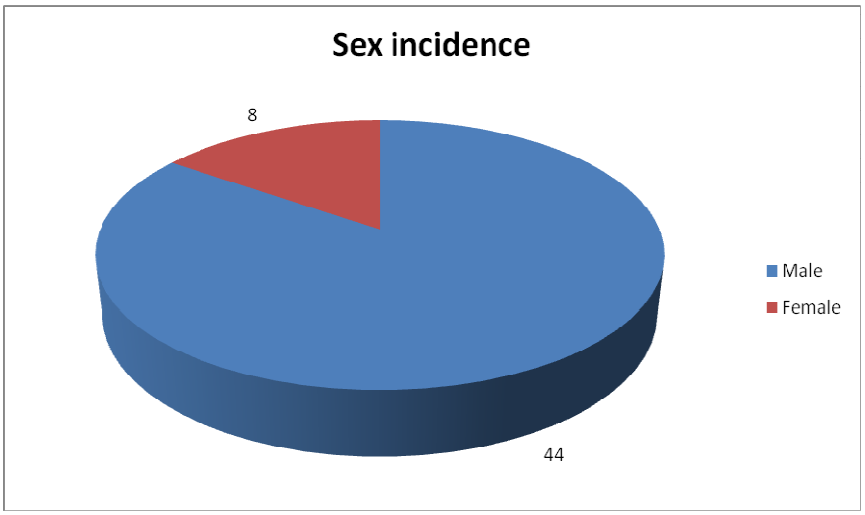
Fig. A . AGE INCIDENCE



B) SEX INCIDENCE

GENDER	NO OF PATIENTS	PERCENTAGE
Male	44	84
Female	8	16

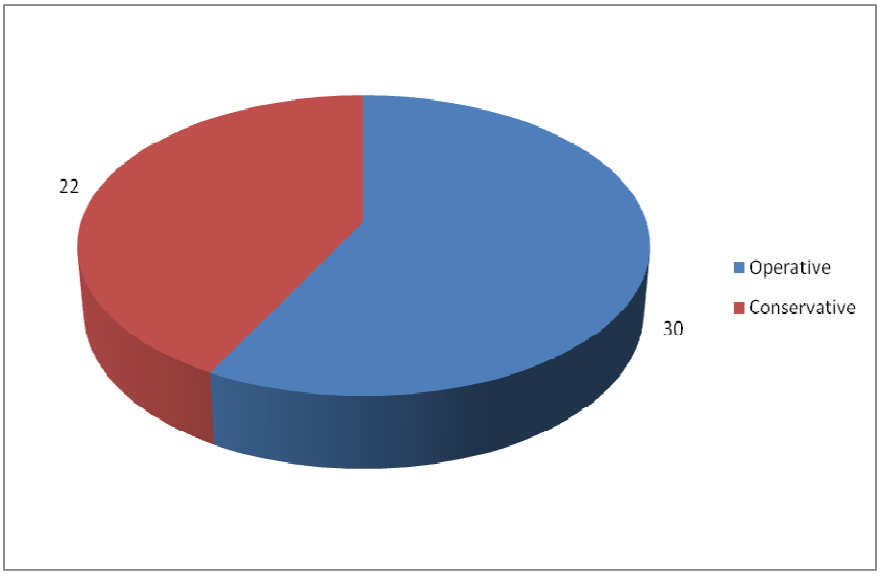
Fig. B. SEX INCIDENCE



C) RATIO OF OPERATIVE TO CONSERVATIVE TREATMENT

	NO OF PATIENTS	PERCENTAGE
Operative	30	58%
Conservative	22	42%

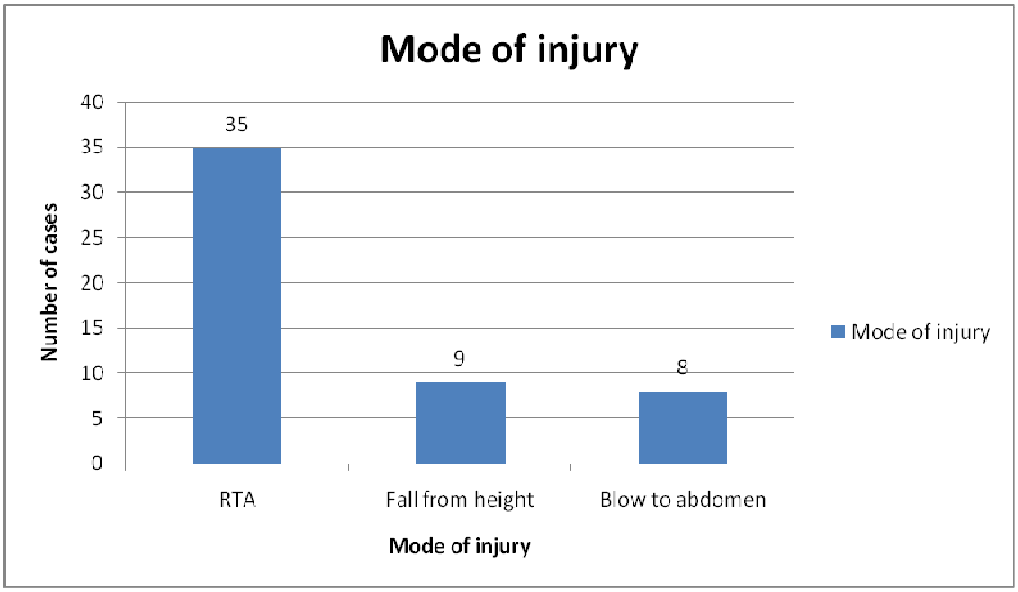
Fig. C. RATIO OF OPERATIVE TO CONSERVATIVE TREATMENT



D)MODE OF INJURY

CAUSATIVE AGENT	NO.OF CASES	PERCENTAGE (%)
Road traffic accident	35	67
Fall from height	9	17
Blow to abdomen with blunt objects	8	15

Fig. D. MODE OF INJURY



E) SYMPTOMS AND SIGNS:-

The following table shows the incidence of various symptoms and signs with which the 52 patients studied.

SYMPTOMS AND SIGNS	NO OF PATIENTS
Abdominal pain	48
Vomiting	7
Abdominal distension	12
Hematuria	2
Pallor	25
Pulse>100/min	45
BP<90mm of Hg systolic	19
Abdominal guarding and rigidity	20
Abdominal tenderness	50
Rebound tenderness	20
Free fluid	20
Liver dullness obliteration	5

HEMODYNAMIC STATUS

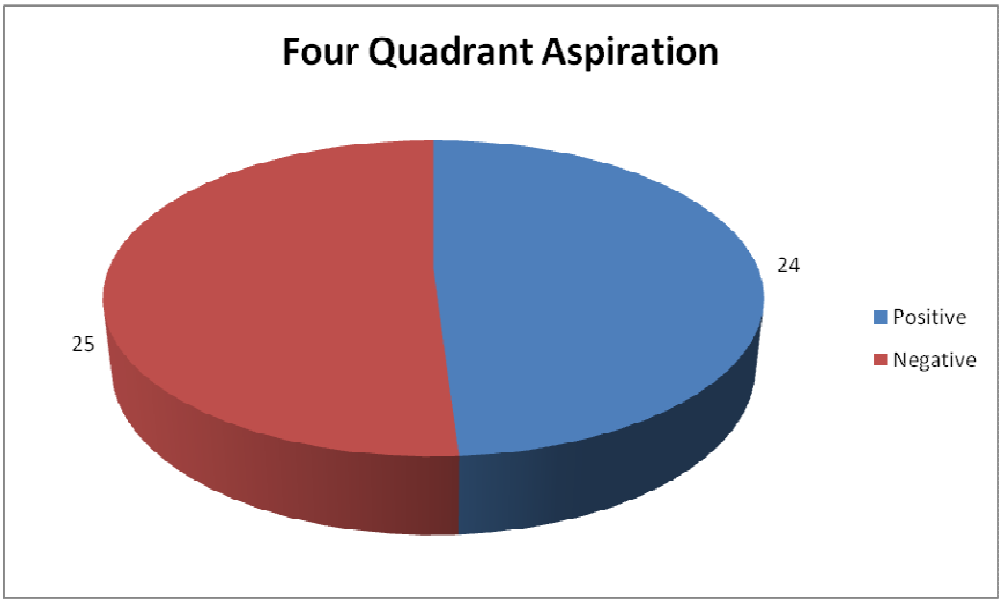
The patient who are taken as unstable condition are Pulse rate > 100/min, BP<90mm of Hg. 18 patients are unstable. 36 patients are stable.

FOUR QUADRANT ASPIRATION:

Four quadrant aspiration was done in 49 patients, among which 24 cases were positive and 25 cases were negative. Out of the 25 negative cases, 10 cases were false negative. On laparotomy, they were found to have hemoperitoneum. DPL is not practiced in our hospital.

RESULT	NO. OF CASES	PERCENTAGE
Positive	24	46%
Negative	25	48%

FIG. G. FOUR QUADRANT ASPIRATION

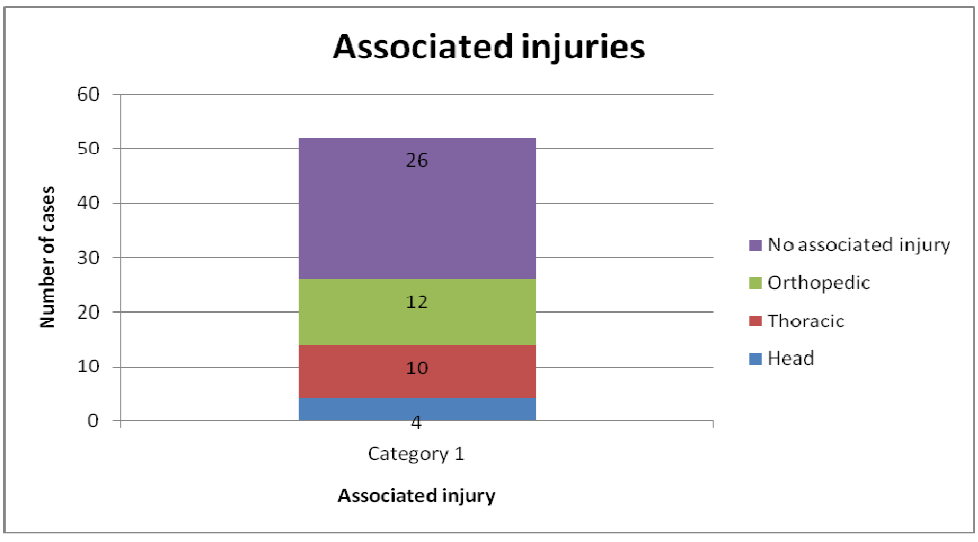


G) ASSOCIATED INJURIES:-

	NO OF CASES	PERCENTAGE
Head	4	8%
Thoracic	10	19%
Orthopedic	12	23%

Associated extra abdominal injuries were found in 26 cases. The common extra abdominal injuries were chest injuries including rib fractures, extremity fractures, pelvic fractures and head injuries.

FIG. E. ASSOCIATED INJURIES



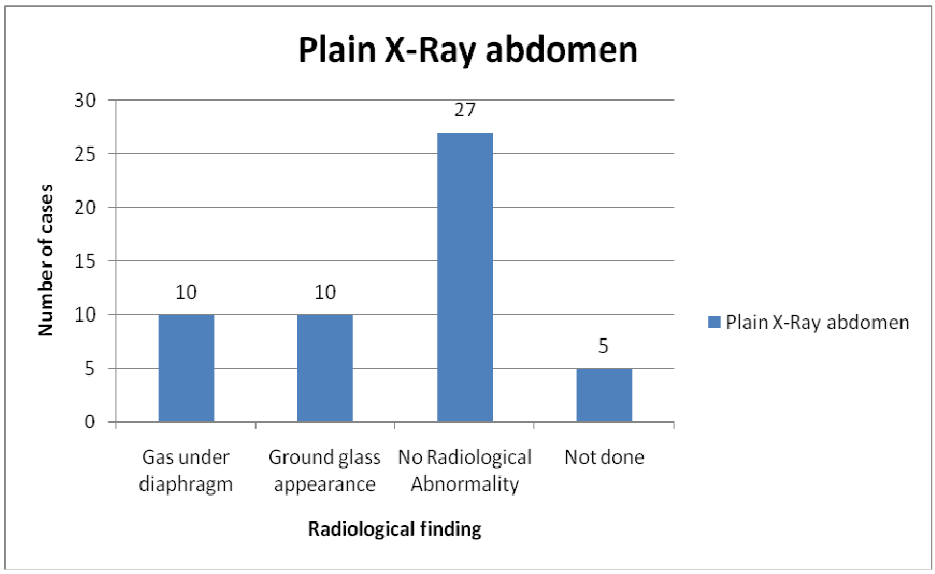
INVESTIGATIONS:

PLAIN X RAY ABDOMEN:

Plain x ray of abdomen was done in 47 cases, out of the total 52 cases. This was not done in 5 patients as the patient's condition did not permit to shift them to the X ray room or they died while being resuscitated for shock. Gas under diaphragm was found in 10 cases out of 17 bowel perforations detected at laparotomy. The following table shows the abnormal findings detected in x ray erect abdomen and their percentage.

FEATURE	NO. OF	PERCENTAGE
Gas under diaphragm	10	19%
Ground glass appearance	10	19%
No radiological abnormality	27	52%
Not done (ND)	5	10%

FIG. F. PLAIN X-RAY ABDOMEN FEATURES



ULTRASOUND EXAMINATION:

A total of 22 patients were subjected for ultrasound examination, out of which 6 patients had scan detected solid organ injuries for which they underwent laparotomy for 4 cases and found to have significant injuries.2 cases managed conservatively. 2 patients had bladder injury which was repaired. 12 with free fluid and 9 of them found to have hollow viscus injury at laparotomy.

CT SCAN:

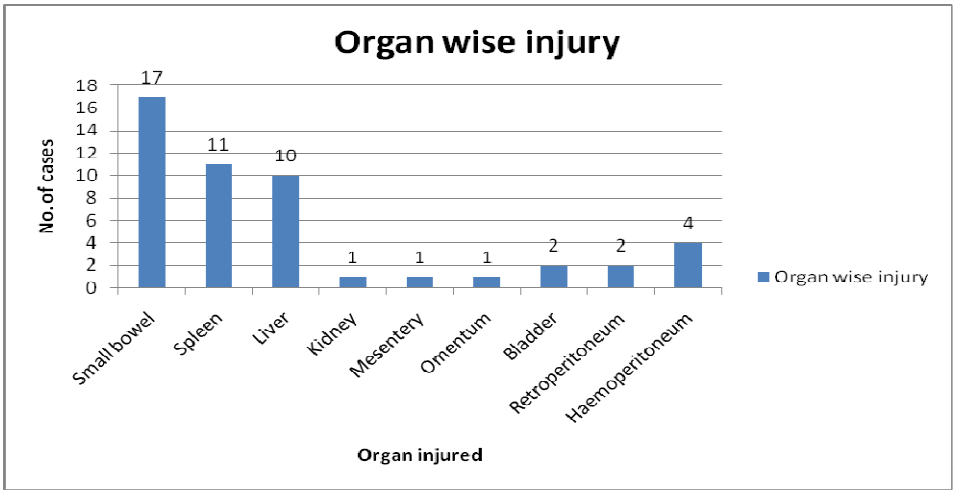
CT scan was done in 15 cases. It identifies the solid organ injuries and its grade, free fluid, retroperitoneal structures. 10 cases have solid organ injury for which they underwent laparatomy in 3 cases, conservatively managed 7 cases.

ORGANWISE INJURY:

In the present series, small bowel was the most commonly involved organ. It was involved in 33% of cases, sple en in 21% and liver in 18% of cases.

ORGAN INJURED	NO. OF CASES	PERCENTAGE
Small bowel	17	32%
Spleen	11	21%
Liver	10	19%
Kidney	1	2%
Mesentery	1	2%
Omentum	1	2%
Bladder	2	4%
Retroperitoneum	2	4%
Hemoperitoneum only	4	8%

FIG. H. ORGAN WISE INJURY



DISCUSSION

AGE INCIDENCE:

The following table compares the incidence of blunt abdominal trauma in various age groups in the present series to that of the Davis et al[5]

AGE GROUP	PRESENT	DAVIS ET AL[5]
11-20	7%	19%
21-30	15%	24%
31-40	17%	15%
41-50	5%	13%
51-60	6%	6%
61-70	1%	3%
71-80	1%	-

It can be seen from the above table that the majority of patients belonged to 31-40 years of age group, followed by 21-30 years age group. In Davis et al[5] study the majority of patients belonged to 21-30 years age group. Therefore it can be concluded that the young and the productive age group people are the usual victims of blunt abdominal trauma.

SEX INCIDENCE:

GENDER	PRESENT STUDY	DAVIS ET AL[5]
Male	84%	70%
Female	16%	30%

From the above table, it can be seen that the males are the more common victims of blunt abdominal trauma. When compared to other studies the incidence of males is much more than those of the females, as, in India males are the chief bread earner for the family and are involved in outdoor activities most of the times.

FOUR QUADRANT ASPIRATION:

In the present study 94% of patients were subjected for four quadrant aspiration as against 44% in Davis ET al[5] study. 24 cases were found to be positive and 25 cases were negative. Out of these 49 cases, 410cases were false negative in the present study. Correct results (positive or negative), as determined by subsequent laparotomy, were obtained in 86% of cases in Davis ET al[5] study.

RATIO OF OPERATIVE TO CONSERVATIVE MANAGEMENT:

TREATMENT	PRESENT STUDY	DAVIS ET	KHANNA ET AL[6]
Operative	58%	77%	58%
Conservative	42%	23%	42%

The above table shows that there is an increasing trend towards conservative management; however the present study shows that 42% of patients were subjected for non operative management. Davis et al[5] showed 23% and Khanna et al[6] showed that 43% of patients were subjected for conservative management. Non operative management is gaining increasing acceptance mainly because of the easy availability of CT scan. With the aid of CT scan it is possible to accurately grade the extent of injury to solid organs like liver and spleen.

Minor lacerations and capsular tears, difficult to diagnose clinically can be easily demonstrated by CT scan and selected for non operative management. The disadvantages of non operative management are those of missed injuries and delayed treatment resulting in excessive morbidity and even mortality.

MODE OF INJURY:

CAUSATIVE AGENT	PRESENT STUDY	DAVIS ET AL[5]	KHANNA ET AL[6]
Road traffic accident	67%	70%	57%
Fall from height	17%	6%	15%
Blow to abdomen	15%	-	-

The above table clearly depicts that the road traffic accident is the most common mode of injury. This is due to the rapid development in technology, in all fields including automobile industry where the first priority has been given to speed rather than safety.

SIGNS AND SYMPTOMS:

In the present study, abdominal pain was the most common presenting complaint accounting for 92% and abdominal tenderness was the most common sign accounting for 92% of cases.

But the signs and symptoms in abdominal injuries are notoriously unreliable and are often masked by concomitant head injuries, chest injuries and pelvic fractures. Significant injuries to the retroperitoneal structures may not manifest signs and symptoms immediately and be totally missed even on abdominal x rays and FQA predisposing the patients to grave consequences of missed injuries.

In Davis et al[5] study, 43% of patients had no specific complaints and no signs or symptoms of intra abdominal injury when they first presented to the emergency room. But 44% of those patients eventually required exploratory laparotomy and 34% of patients had an intra abdominal injury. This emphasizes the importance of careful and continuing observation and repeated examination of individuals with blunt abdominal trauma.

FOUR QUADRANT ASPIRATION

FQA is a simple and important tool in the diagnosis. An aspiration of blood which is not clotted, bilious aspirate (or) with flakes were taken as positive. When the aspirate clotted, The test was taken as negative. Negative aspirate should not ruled out intra abdominal injury. FQA detect Hemoperitoneum. In 14 cases bilious aspiration in 9 cases.

ASSOCIATED INJURIES:

	PRESENT STUDY	**DAVIS ET AL[5]**	**KHANNA ET AL[6]**
Head	8%	9%	12%
Thoracic	19%	27%	24%
Orthopedic	23%	15%	27%

Associated extra abdominal injuries were found in 22 cases. The common extra abdominal injuries were extremity fractures, pelvic fractures, head injuries and chest injuries including rib fractures. The above table shows the comparison of the present study incidences of associated injuries with other studies.

INVESTIGATIONS:

PLAIN X RAY ABDOMEN:

Plain x ray of abdomen was done in 47 cases, out of the total 52 cases. Gas under diaphragm was found in 10 cases out of 17 bowel perforations detected at laparotomy. So the sensitivity of plain x-ray abdomen in detecting the pneumoperitoneum is 58% in the present study. Davis et al[5] reported that in their series, abdominal x ray was abnormal in 21% of cases; pneumoperitoneum was detected in 6% of cases and dilated bowel loops in 6% of cases.

ULTRASOUND EXAMINATION:

A total of 22 patients were subjected for ultrasound examination, out of which 6 patients had scan detected solid organ injuries for which 4 patients underwent laparotomy and found to have significant injuries. 10 patients had scan detected normal solid organs with free

fluid and found to have hollow viscus injury at laparotomy. Therefore ultrasound is more reliable in detecting solid organ injuries and free fluid in the abdomen. In Yoshi H et al study, the sensitivity of ultrasound in detecting injuries in blunt abdominal injury patients is about 94.6%.

ORGANWISE INJURY:

ORGAN INJURED	PRESENT SERIES	CUSHERI[7]	DAVIS ET AL[5]	COX ET AL[8]	KHANNA ET AL[6]
Small bowel	32%	9%	8%	8%	57 %
Colon	2%				
Spleen	21%	25%	25%	46%	26 %
Liver	19%	15%	16%	33%	37 %
Kidney	2%				
Mesentery	2%	5%	4%	10%	47 %
Omentum	2%				
Bladder	4%	6%	4%		
Retroperitoneum	4%				

The above table compares the incidences of the organs involved in blunt abdominal trauma in the present study to that of the international series. Contrary to these international series where spleen is the most common viscera injured, in the present series, GIT is the most commonly involved organ. Small bowel was involved in 32% of cases, followed by spleen (21%), and followed by liver (19%).

OPERATIVE PROCEDURES:

In the present study closure of bowel perforation was done on 13 patients, repair of mesentery in 1 patients, splenectomy in 4 patients, splenorrhaphy in 2 patients, hepatorraphy in 4 patients , resection and anastamosis in 5 patients and 2 patients underwent primary closure of bladder SPC.

In Khanna et al[6] study closure of bowel perforation was done in 13 patients, colostomy in 2 patients, repair of mesentery in 9 patients, splenectomy in 4 patients, splenorrhaphy in 1 patient and hepatorraphy in 6 patients.

MORTALITY:

A total of 6 patients died in the present study. 3 patients belonged to operative group and died in the post operative period.

3 patients died before surgery during resuscitation.

Therefore the mortality in the present study is 11%. The mortality rate in Davis et al[5] study is 13.3%, Di Vincenti et al[10] study (1968) was 23%. Cox et al[8] study reports a mortality rate of 10%

. Association between age, sex, H.Status, CF, FQA, X Ray, USG, CT of the respondents and their Operative Findings

Variables	Operative Findings										Statistical inference
	NA		Negative		Positive - I		Positive - II		Total		
	(n=17)	*(100%)*	*(n=5)*	*(100%)*	*(n=10)*	*(100%)*	*(n=20)*	*(100%)*	*(n=52)*	*(100%)*	
AGE											
Below 20yrs	3	17.6%	1	20.0%	2	20.0%	1	5.0%	7	13.5%	X^2=13.229 Df=12 .353>0.05 Not Significant
21 to 30yrs	5	29.4%	0	.0%	2	20.0%	9	45.0%	16	30.8%	
31 to 40yrs	5	29.4%	1	20.0%	4	40.0%	6	30.0%	16	30.8%	
41to 50yrs	2	11.8%	0	.0%	1	10.0%	2	10.0%	5	9.6%	
51yrs & above	2	11.8%	3	60.0%	1	10.0%	2	10.0%	8	15.4%	
SEX											
Male	15	88.2%	4	80.0%	9	90.0%	16	80.0%	44	84.6%	X^2=.803 Df=3 .849>0.05 Not Significant
Female	2	11.8%	1	20.0%	1	10.0%	4	20.0%	8	15.4%	
H.STATUS											
Negative	14	82.4%	5	100.0%	4	40.0%	10	50.0%	33	63.5%	X^2=9.432 Df=3 .024<0.05 Significant
Positive	3	17.6%	0	.0%	6	60.0%	10	50.0%	19	36.5%	

CF											
Negative	16	94.1%	4	80.0%	6	60.0%	6	30.0%	32	61.5%	X^2=16.759
Positive	1	5.9%	1	20.0%	4	40.0%	14	70.0%	20	38.5%	Df=3 .001<0.05 Significant
FQA											
ND	0	.0%	0	.0%	0	.0%	3	15.0%	3	5.8%	X^2=21.817
Negative	15	88.2%	1	20.0%	2	20.0%	7	35.0%	25	48.1%	Df=6
Positive	2	11.8%	4	80.0%	8	80.0%	10	50.0%	24	46.2%	.001<0.05 Significant
XRAY											
NA	3	17.6%	2	40.0%	0	.0%	0	.0%	5	9.6%	X^2=27.342
Negative	13	76.5%	3	60.0%	6	60.0%	5	25.0%	27	51.9%	Df=6
Positive	1	5.9%	0	.0%	4	40.0%	15	75.0%	20	38.5%	.000<0.05 Significant
USG											
NA	10	58.8%	5	100.0%	6	60.0%	9	45.0%	30	57.7%	X^2=15.987
Negative	4	23.5%	0	.0%	0	.0%	0	.0%	4	7.7%	Df=6
Positive	3	17.6%	0	.0%	4	40.0%	11	55.0%	18	34.6%	.014<0.05 Significant
CT											
NA	7	41.2%	3	60.0%	7	70.0%	20	100.0%	37	71.2%	X^2=18.609
Negative	3	17.6%	0	.0%	0	.0%	0	.0%	3	5.8%	Df=6
Positive	7	41.2%	2	40.0%	3	30.0%	0	.0%	12	23.1%	.005<0.05 Significant

Statistical test: Chi-square test was used the above table

Inference

The above table shows that there is a significant association between H.Status, CF, FQA, X Ray, USG, CT of the respondents and their Operative Findings. Hence, the calculated value less than table value ($p<0.05$)

The above table shows that there is no significant association between age, sex of the respondents and their Operative Findings. Hence, the calculated value greater than table value ($p>0.05$)

1.Most of the patients who were unstable at the time of admission had positive findings at laparotomy.

2.From the above table it is clear that with the help of radiological investigations there is a increase in trend towards conservative management.

SUMMARY AND CONCLUSIONS

A prospective study of 52 cases of blunt injury abdomen was made to correlate clinical findings and radiological investigations in THANJAVUR MEDICAL COLLEGE, THANJAVUR, during January 2011 to June 2012.

From the study the following conclusions are made:

1. All cases of blunt injury abdomen should be viewed with high degree suspicion, to rule out solid/hollow viscus injury either by clinical and radiological examination, since the morbidity and mortality in blunt injury abdomen is high.
2. The mainstay of diagnosing blunt injury abdomen is by thorough and repeated clinical examination.
3. By adding radiological investigations to clinical examination ,we avoid negative laparotomies which by itself can cause morbidity and mortality.

4. Radiological investigation like CT abdomen and USG abdomen not only help in diagnosing the injured organ but also help in grading the severity of injury, thus less severe injuries are managed conservatively,

while more severe injuries require laparotomy. Patients who are managed conservatively should be scrutinized with clinical and appropriate radiological investigations.

5. By the advancements in radiological investigations there is increase in trend towards conservative managements.
6. Further with the help of radiological investigations we can know the organ involved, and we can plan preoperatively regarding the management, which will lessen the operating time and give better outcome.

SNO	NAME	AGE	SEX	MODE	H.STATUS	CF	FQA	ASSO.INJ	CD	XRAY	USG	CT	OPERATIVE FINDINGS	PROCEDURE	COMPLICATIONS	OUTCOME
1	THIRUMANI	22	M	RTA	S	T	-	-	BIA	NRA	FF	LIVER LACERATION	CONS	-	-	R
2	MADHU	18	M	RTA	S	T,G,L	ND	-	BIA+HVP	AUD	FF	-	JEJUNAL TEAR	CLOSURE	-	R
3	NAGARAJA	14	M	FFH	S	T	-	-	BIA	NRA	-	SPLENIC LACREATION	CONS	-	RI	R
4	RENGANATHAN	32	M	RTA	US	G	+	RIB#	BIA+HP	NRA	-	-	GR4 SPLENIC INJURY	SPLENECTOMY	-	DP
5	SUSEELA	32	F	RTA	S	T,G	+	HEAD INJURY	BIA+HP	NRA	-	-	HP	-	-	R
6	AYYAPPAN	32	M	FFH	US	T,G,R	-	-	BIA	NRA	FF	-	DUODENAL PERF	CLOSURE	WI	R
7	MANJUNATHAN	22	M	RTA	S	T	-	-	BIA	NRA	N	N	CONS	-	-	R
8	RAJENDERAN	30	M	RTA	US	T	+	PELVIC#	BIA+HP	GGA	-	-	BLADDER INJURY	REPAIR+SPC	RI	R
9	RAMESH	31	M	BWB	S	T	+	-	BIA+HP	NRA	N	-	CONS	-	-	R
10	RAJKUMAR	19	M	RTA	S	T	+	-	BIA+HP	-	-	-	HP	-	-	R
11	RAVI	21	M	RTA	S	T	-	-	BIA	NRA	-	SUB CAPSULAR HEMATOMA SPLEEN	CONS	-	-	R
12	HARISH	25	M	BWB	S	T	-	# BB R FA	BIA	NRA	FF	-	ILEAL PERF	CLOSURE	WI	R
13	PAPATHI	45	F	RTA	US	T,G,L	+	-	BIA+HVP	AUD	-	-	ILEAL TEAR,MESENTRIC CONTUSION	R+A	WI,RI	R
14	MARIAPPAN	60	M	RTA	S	T	+	-	BIA+HP	NRA	-	-	HP	-	-	R
15	KALIYAMOORTHY	56	M	RTA	S	T,G	+	# R FEMUR	BIA+HVP	AUD	FF	-	JEJUNAL PERF	CLOSURE	-	R
16	PONNAN	35	M	BWB	S	T	-	-	BIA	NRA	-	SPLENIC INJURY	CONS	-	-	R
17	LAKSHMANAN	33	M	RTA	S	T	-	RIB#	BIA	NRA	N	-	CONS	-	-	R
18	GOVINDARAJ	24	M	BWB	US	T	+	L HEMOTHORAX	BIA+HP	GGA	SPLENIC INJURY	-	GR3 SPLENIC INJURY	SPLENECTOMY	RI	R
19	NARENDERAN	16	M	RTA	US	T,G,R	+	# CLAVICLE,R HEMOTHORAX	BIA+HP	GGA	-	-	GR2 LIVER INJURY	HEPATORAPHY	WI	R
20	MD.AZAR	25	M	RTA	S	T,G,L	ND	-	BIA	AUD	FF	-	JEJUNAL PERF	CLOSURE	-	R
21	ISMAIL	25	M	RTA	US	T	-	#PUBIC RAMUS	BIA	NRA	FF, BLADDER INJURY	-	BLADDER INJURY	2 LAYER CLOSURE	-	R
22	KAMALAM	26	F	RTA	S	T,G	+	RIB#, # ULNA	BIA+HVP	AUD	-	-	JEJUNAL PERF	CLOSURE	-	R
23	TIRUPATHY	55	M	RTA	S	T	+	-	BIA	NRA	-	FF	HP	-	-	R
24	RAGHU	32	M	RTA	S	T,G	+	-	BIA+HP	NRA	SPLENIC INJURY	-	GR2 SPLENIC INJURY	SPLENORAPHY	-	R
25	MOORTHY	30	M	BWB	US	T,G	+	# HUMERUS	BIA+HVP	AUD	-	-	DUODENAL PERF, JEJUNAL PERF	CLOSURE	WI	DP
26	GOPAL	45	M	RTA	S	T	-	-	BIA	NRA	-	LIVER INJURY	CONS	-	-	R
27	SIVAKUMAR	14	M	FFH	S	T	-	RIB#	BIA	NRA	LIVER INJURY	LIVER INJURY	CONS	-	-	R
28	SOMASUNDARAM	30	M	RTA	US	T	+	L HEMOTHORAX	BIA+HP	NRA	-	SPLENIC INJURY, L RENAL CONTUSION	GR3 SPLENIC INJURY	SPLENECTOMY	RI	R
29	SUBBAIYA	60	M	FFH	US	T	+	# NOF	BIA+HVP	GGA	-	-	-	-	-	D
30	JEGANATHAN	36	M	RTA	S	T,G	ND	-	BIA	NRA	FF	-	JEJUNAL PERF	CLOSURE	-	R
31	NEELAMBAL	56	F	FFH	US	T	-	HEAD INJURY, PELVIC#	BIA	-	-	-	-	-	-	D
32	VELU	28	M	RTA	US	T	+	-	BIA+HP	NRA	FF	-	JEJUNAL PERF	CLOSURE	-	R
33	SRINIVASAN	32	M	FFH	S	T,G	-	CS SPINE	BIA	GGA	-	-	ILEAL PERF	R+A	-	R
34	RAJU	40	M	RTA	S	T	-	-	BIA	NRA	-	N	CONS	-	-	R
35	SANJAI	18	M	RTA	S	T	-	-	BIA	NRA	FF	SPLENIC INJURY	GR2 SPLENIC INJURY	SPLENORAPHY	WI	R
36	SIVARAJ	25	M	RTA	S	T	-	-	BIA	NRA	-	SUB CAPSULAR HEMATOMA LIVER	CONS	-	-	R
37	SUSEELA	46	F	RTA	S	G	+	HEAD INJURY	BIA+HVP	GGA	FF	-	JEJUNAL PERF	CLOSURE	WI	R
38	KUMAR	42	M	RTA	S	T	-	-	BIA	NRA	-	N	CONS	-	-	R
39	MAHALINGAM	36	M	FFH	US	T	-	# BB R LEG	BIA	GGA	FF	-	ILEAL PERF	CLOSURE	WI	R

40	SANJIVAKUMARI	33	F	BWB	S	T	+	-	BIA	NRA	LIVER INJURY	-	LIVER LACERATION, OMENTAL AND SI CONTUSION	HEPATORAPHY	WD	R
41	NARAYANAN	34	M	RTA	US	T,G	-	-	BIA	AUD	-	-	TC PERF,SEROSAL TEAR ILEUM	CLOSURE	-	R
42	MAHESH	25	M	RTA	S	T	+	RIB#	BIA+HVP	AUD	-	-	JEJUNAL PERF	CLOSURE	-	R
43	SAGUNGHALAI	64	F	RTA	S	T,G,L	-	-	BIA	AUD	-	-	JEJUNAL PERF	CLOSURE	RI	R
44	JAYARAMAN	40	M	RTA	S	T	-	-	BIA	NRA	-	LIVER LACERATION	LIVER LACERATION, SPLENIC LACERATION	HEPATORAPHY	-	R
45	PANDIAN	32	M	FFH	S	T	-	# ILLIAC BONE	BIA	NRA	N	-	CONS	-	DVT	R
46	RAJESH KUMAR	18	M	RTA	US	G	-	R PNEUMOTHORAX, HEAD INJURY	BIA	-	-	-	-	-	-	D
47	MANIMEGALAI	23	F	BWB	S	T	-	-	BIA	-	SPLENIC INJURY	-	CONS	-	-	R
48	ADHIMOOLAM	80	M	RTA	US	T	+	-	BIA+HP	GGA	-	-	LIVER LACERATION	DAMAGE CONTROL S	-	DP
49	KRISHNAMOORTHY	46	M	RTA	US	T,G	+	L HEMOTHORAX	BIA+HP	GGA	-	-	SHATTERED SPLEEN, LIVER LACERATION	SPLENCTOMY	RI	R
50	THIYAGARAJAN	38	M	RTA	US	T,G,L	+	-	BIA+HVP	AUD	FF	-	JEJUNAL TRANSECTION, MESENTRIC TEAR	R+A, MESENTRIC REP	WI,LEAK	R
51	VENKETESH	55	M	FFH	S	T	-	-	BIA	-	-	FF	HP	-	-	R
52	MURUGASEN	30	M	BWB	US	T,G	+	-	BIA	GGA	-	-	JEJUNAL PERF 2	R+A	-	R

LIST OF ABBREVIATIONS USED

ARDS - Acute respiratory distress syndrome

CBD - Common bile duct

CHD - Common hepatic duct

CPR - Cardiopulmonary resuscitation

CT - Computed tomography

CVP - Central venous pressure

DPL - Diagnostic peritoneal lavage

ECG - Electrocardiogram

ERCP - Endoscopic retrograde cholangiopancreatography

GCS - Glasgow coma scale

ICS - Intercostals space

ICU - Intensive care unit

IV - Intravenous

IVC - Inferior venacava

KUB - Kidney, ureter, bladder x ray film

MRI - Magnetic resonance imaging

PCN - Percutaneous nephrostomy

USG - Ultrasonography

H.STATUS	HEMODYNAMIC STATUS, S-STABLE/US-UNSTABLE
CF	CLINICAL FEATURES
T	TENDERNESS
G	GUARDING
R	RIGIDITY
L	OBLITERATION OF LIVER DULLNESS
FQA	FOUR QUADRANT ASPIRATION
CD	CLINICAL DIAGNOSIS
RTA	ROAD TRAFFIC ACCIDENT
FFH	FALL FROM HEIGHT
BWB	BLOW WITH BLUNT OBJECT
BIA	BLUNT INJURY ABDOMEN
HP	HEMOPERITONEUM
HVP	HOLLOW VISCUS PERFORATION
NRA	NO RADIOLOGICAL ABNORMALITY
AUD	AIR UNDER DIAPHRAM
GGA	GROUND GLASS APPEARANCE
FF	FREE FLUID
R+A	RESECTION AND ANASTAMOSIS
RI	RESPIRATORY INFECTION
WI	WOUND INFECTION
WD	WOUND DEHISCENCE
R	RECOVERED
D	DIED
DP	DIED POST OPERATIVELY

PROFOMA

BLUNT INJURY ABDOMEN

NAME: **DOA:**

AGE/SEX: DATE & TIME OF INJURY:

IP.NO: MODE OF INJURY:

OCCUPATION:

ADDRESS:

PERSENTING COMPLAINS:

Pain

Vomiting

Hematuria

Passed urine/stools/flatus

PAST HISTORY

PERSONAL HISTORY

INITIAL ASSESMENT OF PATIENT

VITALS

Pulse Rate

Blood pressure

Respiratory rate

Temperature

GENERAL SIGNS

Pallor

Hydration status

ASSESMENT OF ABDOMINAL INJURIES

Tenderness

Guarding

Rigidity

Discolouration of abdominal wall

Obliteration of liver dullness

Free fluid

Bowel sounds

Per rectal& Pre vaginal examination

Four quadrant aspiration

ASSOCIATED INJURIES

Head

Spine

Chest

Extremities

OTHER SYSTEM EXAMINATION

CVS

RS

CNS

BASIC INVESTIGATIONS

Complete hemogram

Random blood sugar

Renal function test

Serum electrolytes

Urine analysis

Blood grouping typing

RADIOLOGICAL INVESTIGATIONS

Chest X-Ray/X-ray abdomen erect(or)supine

USG Abdomen & Pelvis

CT Abdomen

IVU

PRE OPERATIVE DIAGNOSIS

OPERATIVE PROCEDURE

ANESTHESIA

OPERATIVE PROCEDURE

POST OPERATIVE PERIOD

Wound infection

Wound dehiscence

Respiratory infections

Ileus

DVT

Others

FOLLOW-UP

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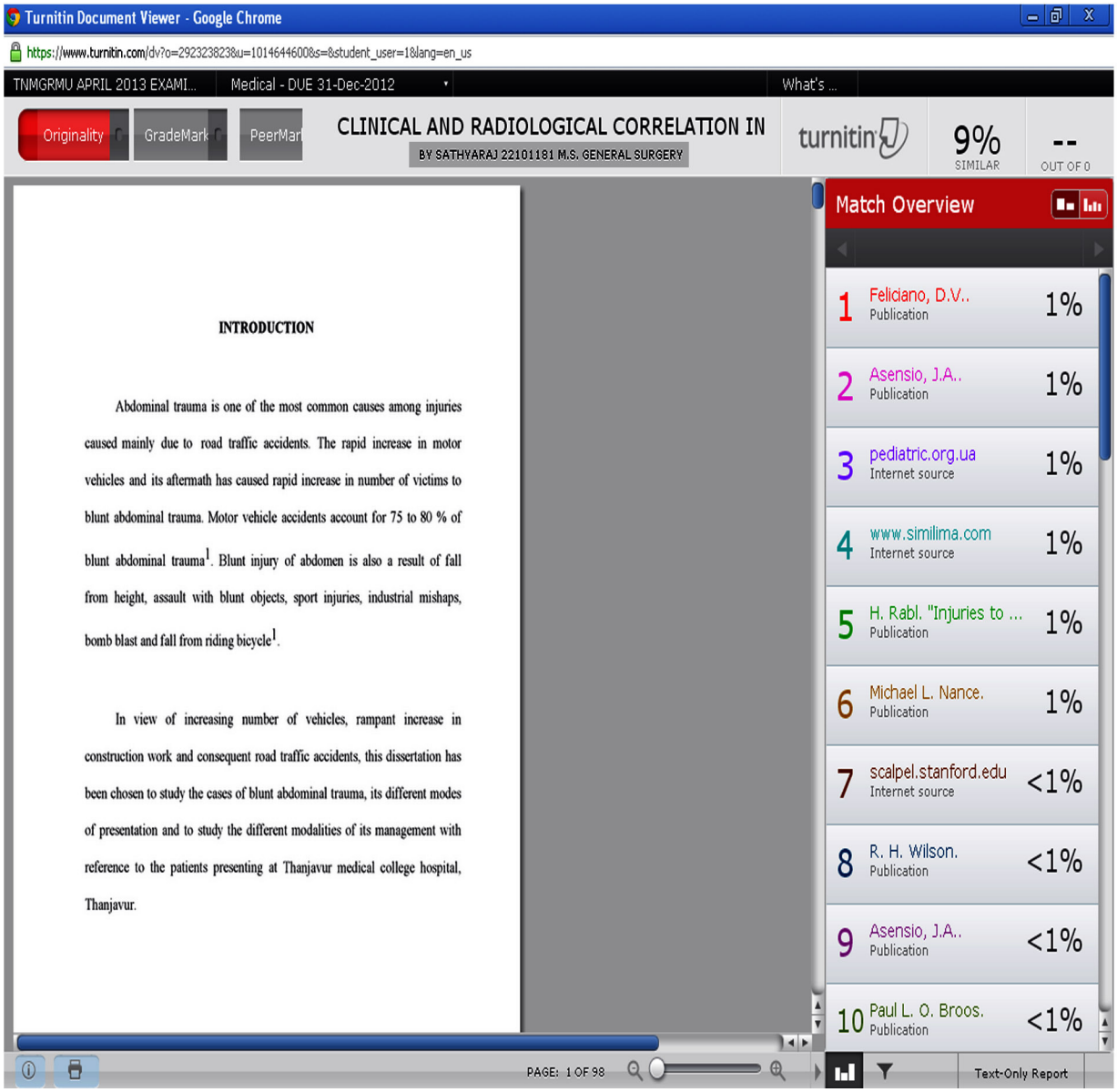
INTRODUCTION Abdominal trauma is one of the most common causes among injuries caused mainly due to road traffic accidents. The rapid increase in motor vehicles and its aftermath has caused rapid increase in number of victims to blunt abdominal trauma. Motor vehicle accidents account for 75 to 80 % of blunt abdominal trauma 1 . Blunt injury of abdomen is also a result of fall from height, assault with blunt objects, sport injuries, industrial mishaps, bomb blast and fall from riding bicycle 1 . In view of increasing number of vehicles, rampant increase in construction work and consequent road traffic accidents, this dissertation has been chosen to study the cases of blunt abdominal trauma,...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INTRODUCTION
Abdominal trauma is one of the most common causes among injuries caused mainly due to road traffic accidents. The rapid increase in motor vehicles and its aftermath has caused rapid increase in number of victims to blunt abdominal trauma. Motor vehicle accidents account for 75 to 80 % of blunt abdominal trauma[1]. Blunt injury of abdomen is also a result of fall from height, assault with blunt objects, sport injuries, industrial mishaps, bomb blast and fall from riding bicycle[1].
In view of increasing number of vehicles, rampant increase in construction work and consequent road traffic accidents, this dissertation has been chosen to study the cases of blunt abdominal trauma, its different modes of presentation and to study the different modalities of its management with reference to the patients presenting at Thanjavur medical college hospital, Thanjavur.
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